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BRIEFLY TOLD.

THE OUTLOOK.—The close of the first half of the year finds the gas industry of the country in nothing short of excellent condition, and this conclusion cannot be truthfully gainsaid. We have determined this year to depart somewhat from our usual custom in respect to giving a percentage summary of the differences in output, the estimate being made from figures of increase or otherwise in sendout obtained from what may be called test points, and believe that our readers will agree with us in the opinion that the change will be an improvement. Heretofore the figures were given from compilations ending at various dates in May and June, or in November and December, hence were ragged and uneven, but hereafter our summaries will (as near as it is possible to cause them to do) refer to the terms ending with June 30th and December 31st. This will necessarily defer their appearance in our columns until a late issue in July and January, respectively. In the meantime, however, from the figures so far registered, we believe it is safe to claim an average increase over the country, as to the gas sendout in the first half of '91, compared with the like period of '90, of fully 15 per cent. This cannot be other than gratifying to the fraternity, whose intelligent direction of their business, in the face of sharper competition than ever, both from kerosene and incandescent electric lighting, is thus vividly shown. We would esteem it a favor if our letters of inquiry are promptly answered, and those who prefer to give the percentages, instead of the extended records of their output, etc., as noted in the circular forwarded, may select that method of replying. We presume it is not necessary to say it here in so many words, but those who oblige us with the statements asked for can rest assured that their figures, save in a concrete mass, will not be revealed in any shape or form to others than those whose duty it is to prepare the facts for publication.

THE situation in Brooklyn presents no new features, the Companies accepting the $1.25 rate in a spirit of resignation born of the reassuring fact that a tremendous increase in their output has already come to pass. Another odd thing in connection with it is that the consumers actually admit that their gas bills are smaller than when the rate was $1.50. Certainly, "Things are not as they used to be."

[Special Editorial Correspondence.]

THE GUILD'S MIDSUMMER OUTING.

MR. EDITOR: On Friday evening, June 19, a party composed mostly of members of the Guild of Gas Managers, with a few choice spirits of the New England Association, left Boston, on the steamer Penobscot, for a fraternal visit to Brother Boardman, of the Bangor Gas Light Company, to enjoy a few days' relaxation along the shores of Maine, and to breathe with Blaine the far-famed pine laden breezes of Bar Harbor.

The party numbered by count 33, but numbered by the fun they had and the noise they made, there were considerably over a hundred.

The average New England gas man is a rare bird. Visit him at his home in his own town and you will find a hearty greeting, but an eminently proper one, dignified and serious, as, with a mind solely on business intent, he moves steadily on his path of conscious rectitude. At his Association meetings he lets out a button. He enjoys himself with carefully modulated hilarity; no roughness, no boisterousness; he seldom departs from the rules of polite society, and always keeps within the 10 per cent. limit. But on a trip like this—great Scott! Did you ever, Mr. Editor, hear of a man going to bed so full of the buoyant spirit of joy that in the night, he fell out of the lower berth into the upper one, and found himself in a blue shirt while he went to bed in a white one; or did you ever meet one who would put his socks in the water pitcher and then try to shut it up like a valise? Yet these are but two of the incidents of that first night on the boat!

We owned the boat, as we did everything we had a use for on the trip. Capt. Ingraham extended to us the right hand of fellowship, we charmed the steward with our appreciation of his food, the waiters with our music and our quarters, the engineers with our knowledge of engineering, the ladies with our beauty (the most modest man in New England was with us), and everybody generally with our hospitality.

Starting in rather stormy weather, the morning dawned clear, and after a beautiful sail along the shores and by the blue hills of Camden, we reached Bangor at 3 P. M. on Saturday. Here came the most depress-

ing circumstance of the trip. Boardman had the whooping cough and couldn't be with us except in spirit, but his son was on deck, as were the officials of the Gas Company, who gave us a cordial welcome. A most enjoyable buckboard drive was had about the city, and as Boardman could not come to us, we went to him, and, in unison, whooped her up. It did him good and did us good. What a lunch was spread! What spring water! (Maine, you know, is prohibition). Then we assembled on the lawn where Mr. Harbison gracefully complimented the host and hostess, and our end man addressed the assembled "citizens and citizenesses." From here the drive continued to Veazie, where we inspected the largest water power electric station in the world, and finally to the hotel.

In order not to miss the boat next morning, a delegation sat up and watched for the first flush—of dawn, and at 9 o'clock the steamer Bismark, named in honor of one of the party, was taken for Bar Harbor. The sail on that beautiful June Sunday was one never to be forgotten. For 50 miles we sailed down the beautiful Penobscot river, whose shores rival those of the Hudson, then through the Egemoggin reach, dotted with its hundreds of islands, and finally the magnificent approach to Bar Harbor, with its wild shores and rugged mountains.

Reaching Bar Harbor at 4 o'clock, buckboards were taken for a drive about Eden, and to the summit of Green Mountain, returning at dark to the West End Hotel. The hotel was opened for the party, the regular season not having begun, and although it had 280 rooms, our party filled it to overflowing!

Another night of sleep, grudgingly given, and we awake to find it foggy and rainy, but the morning passed all too soon in listening to music by our choir, watching the play with red, white and blue scenery, running races in the music room, and slugging matches on the piazza. Then came the return to Rockland where we met our boat, the Penobscot, and reached Boston on Tuesday morning, dating our ages back just one year.

To say it was an enjoyable trip is to put it mild. A hint of its pleasures I have tried to give you; another hint is contained in a series of 20 views taken by a photographic fiend in the party. Some of the groups are worth a day's journey to see, and the taker expects to receive a large revenue by simply suppressing them.

Too much praise cannot be given Messrs. Waldo Bros., of Boston, for their thoughtful arrangement of the many details of the trip, to their Mr. T. W. Thomas, who chaperoned us, to Mr. Boardman, to his son who was "wid us," and to the officials of the Gas Company. We shall remember them all and our trip for many years to come.

A New Englander.

Correspondence

[The Journal is not responsible for the opinions expressed by correspondents.]

Mr. Egner's Men Bid Him Good-Bye.

St. Louis, Mo., June 29, 1891.

To the Editor American Gas Light Journal:

The writer witnessed a very touching scene in the Union Depot, this city, on the evening of last Saturday. It was the occasion of the departure of Mr. Frederic Egner, for New York City, to assume the duties of his new position with the Standard Gas Company. Mr. Egner was escorted to the depot by Messrs. Chollar and Brown, the Division Superintendents of the Laclede Gas Company, and about 50 men who had been under the direction of Mr. Egner. As the time approached for the departure of Mr. Egner's train, it was very evident that Mr. Egner and the men were greatly agitated. He spoke a few eloquent words of encouragement to them, as they gathered around him, and as he grasped in turn each brawny hand and said good-bye, the welling tears told that the grief at parting was genuine, and from the heart. As the train moved out on its flight eastward, the delegation sorrowfully turned away, marching with bowed heads out of the depot, each, no doubt, saying to himself, "Indeed, I have lost a good friend."

The handsomely embossed set of resolutions presented to Mr. Egner is displayed in the show window of the Mermod-Jaccard Company, where the work of preparing the same was done. The affair is very neat, and the spontaneous way in which the thing was carried out must have been very gratifying to Mr. Egner.

It is seldom that one chances to witness an expression of such feeling shown by men who are accustomed to the hardest kind of labor in their every-day life. Then, again, one would naturally expect to hear a cheer of "good luck" for their departing friend, but not a word. Their sorrow was, indeed, deep seated. Mr. Egner goes to New York with many a hearty wish of success. Yours, etc., An Observer.

[A Paper read before the Incorporated Gas Institute.]

On the Raising of a Retort House Roof.

By Mr. C. Stafford Ellery.

This paper deals with a subject lacking that interest which attaches to most of the contributions to the proceedings of the Incorporated Gas Institute, in that roof raising is not, like carbonizing, an every-day operation, nor even, like gasholder building, a work to be undertaken periodically. At the same time, many managers are just now measuring their retort houses, and making calculations, in view of possible improvements in the way of either new arches for inclined retorts, or of machinery for more economically handling coal and other material. How best to secure more head room must be the first question in some works. To remove the covering and take down the framework of a roof, for the purpose of adding to the height of the walls, is both costly and troublesome. The suggestion of the writer is that most roofs may be lifted bodily any reasonable height, and safely supported while the walls are being built up. Little or nothing appears to have been written upon the subject of raising roofs, so that a brief record of what has been accomplished in one case may be of some slight service, and may perhaps suggest ideas of what to avoid, as well as what to do, in similar undertakings. Should this paper elicit discussion in the way of experience of other engineers, the object of the writer will have been attained.

The retort house referred to here is one of a series. It contains a bench of eight settings, fitted up with 112 mouthpieces. The ground area, measuring about 116 feet by 80 feet, is covered by a pair of roofs. The height, before the work commenced, from the floor to the under side of the shoes was about 20 ft. 6 in., and, after raising, about 27 feet. Each roof contains 15 principals; and the dimensions are as follows: Rafters, 3 in. by 4 in. T-iron, 24 ft. long; struts, 2½ in. by 2½ in. by ⅜ in. T-iron; tie-rod, 3½ in. by ½ in. flat iron; king and queen bolts, 3½ in. by ½ in. flat iron. The laths for tiles are 1½ in. by 1½ in. angle iron, bolted to rafters. Rise of roof, 12 ft. 4 in. The dead weight of each roof was calculated to be not less than 65 tons. The total weight lifted may be set down at about 130 tons.

In the estimate, account was taken of dirt and soot accumulated on the tiles and framework, and allowance was made for wind pressure and rain. A storm came to test the efficiency of the plant and tackling at a very critical time, when the whole fabric was high in the air, but the contractors (Messrs. Stothert & Pitt, of Bath) had made such admirable arrangements that the work was executed without mishap.

The roof was originally supported on light girders of short span. As it was decided to substitute for these girders 60 feet in the clear, provision had to be made for supporting the roof while the work was in progress. This was done by means of timber props, with special cast iron shoes. These props were made each of three deals, 9 in. by 3 in., bolted together, forming a column 9 inches square, and supporting a line of 11 in. by 4 in. red deal planks, on which rested the special cast iron shoes—one shoe to each principal. These shoes were adopted in order to get the weight of the roof on the roots of the rafters, space sufficient for the new girder being allowed between the props.

Everything being secured, the jacks were put in position, and the weight of the roof taken sufficiently on the props to release the old girders. These were then removed, and the new girders put in position; the permanent shoes being securely bolted to the top flange of the girder with as little delay as possible, in order to tie the two roofs together. During erection, these girders were supported by cross pieces clamped to the props already referred to.

The roofs were now supported in the middle by this girder in three spans running the full length of the house; on the west side, by a similar girder; and on the east side, by the wall of the adjoining retort house. Special arrangements were needed for lifting this end of the principals. Timber walings were placed in line, but not in contact with the wall. These being securely bolted together, supported the shoes fitted to the rafters. All this timber was slung to the rafters until the jacks were rigged up for lifting. To reduce the cost of the scaffolding, long hangers of wrought iron were made to carry one narrow deal. These were slung to the tie rods, and formed a stage the entire length of the house for the workmen to get about upon.

The guttering and two lower courses of tiles were removed, as were also a few rows at the end of the laths where these and two principals overhung the point in the girder where the strain was taken by the jacks. This was done as a measure of precaution, since, during the operation of lifting, when the ends were taken off their bearing on the wall, a portion of the girder, with its load of ironwork and tiles, was subjected to strains different in character from those which it was de-

signed to resist. Experience went to show that this precaution was not necessary, nor need the guttering have been removed, except for the purpose of getting at the shoe bolts for the new girders.

To prevent lurching laterally, and to provide against any possible twisting in the girder, two pairs of legs were fitted up in the following manner: Two struts, 11 in. by 4 in., of red deal, with stiffening pieces bolted to the outside, were fitted into the roots of the top angles of the girders. The bottom ends of these struts were made to slide between two cleats, fastened to a 14 in. by 8 in. pitch pine baulk. The ends of the struts were connected, by two pairs of 3-ton Weston blocks, to an anchor in the middle of the baulk. As the roofs were raised, the blocks were hauled upon, and in this manner the struts were kept always tight against the top flange of the girder. Any tendency to tilt endwise was prevented by anchoring the girders with chains to the retort stack. It may be well to state that this tendency to move out of position was observed on more than one occasion; and while no harm was done, sufficient proof was given that the precautions before mentioned were in the highest degree necessary.

The jacks used for taking the weight of the roof while the girders were being exchanged were double screw jacks. Those for lifting were 50 ton hydraulic ship jacks, placed on sound baulks of pitch pine resting on a brick and concrete floor. It was found in practice that more powerful jacks would have been an advantage. A 12-inch square pitch pine baulk, placed on end, was used between the jack and the girder. Wrought iron straps secured to the bottom flange of the girder, and bolted to the baulk, kept it in position when lifting, and also while the jack was being run back, and prepared for a fresh lift.

The foregoing comprised the first or preparatory stage of the work, and consumed the greatest portion of time, thought and money. The second or lifting stage was more interesting, and quickly got through. Two jacks were placed in position under center girder, something like 60 feet apart. The first lift did not exceed 6 inches, when the packing was made up, and the weight taken off the jacks. The outer ends of the principals were then jacked up about 12 inches in a similar manner; first one roof being dealt with, and then the other. The jacks were then again put to work under the center girder, which this time went up about 12 inches; and so the process continued until the roofs were raised about 6½ feet. The piers for supporting the ends of the girders were built up in brick and cement as each lift was completed—one girder always being landed before the other was raised. This gave much steadiness to the fabric, and counteracted somewhat the comparative unrest of the wood packing. Indeed, the unsteadiness of the packing, due to the compressibility of the timber under such great weights, was one of the most troublesome matters to contend against. But in the later lifts some cast iron mouthpieces were called into requisition and substituted for the timber; and these proved useful and suitable. After the last lift, when the roof was above the proposed height, the cast iron columns were placed in position. These were each in two lengths of about 11½ feet each. The end piers, capped with pennant stone pads set in cement, were carefully levelled with the tops of the columns, and the girders were then lowered into position.

For the purposes of exact levelling, a datum line was cut in the walls under each bearing, and frequent measurements were taken as the work proceeded. After the girders and shoes had been all landed, the main walls were built up and made good, the laths properly set, and the tiles replaced.

It was gratifying to find that no bolts or rivets were broken or required renewing; nor were the tiles damaged. Some few new tiles were needed to replace those found flawed by heat from the retort stack after some years' service.

The cost of carrying out such work will, of course, vary according to circumstances. It may be set down, for a roof such as that referred to—not including girders, which were a special requirement in this case—at about £350 to £400.

[A Paper read before the Incorporated Gas Institute.]

On the Enrichment of Coal Gas by Carbureting Materials Other Than Cannel.

By Prof. Vivian B. Lewes, F.C.S.

At no period since the introduction of coal gas has the subject of carburation been of such interest and importance as it is at the present moment. For the last few years, the gas manager has been gradually realizing that the supply of first-class and even second-class cannel has been so rapidly diminishing in quantity and increasing in price, that the time was near at hand when other methods of keeping up and increasing the quality of the gas supply must be adopted; and my object in bringing this paper before you is to review some of the newest methods at our disposal for this purpose, and, if possible, to excite a discussion worthy of one of the most important questions of the day.

In a course of Cantor Lectures which I gave last winter at the Society of Arts, I dealt with several phases of this subject; and the kindly interest which many of you took in the work I then brought forward encourages me now to review some of it by the light of new experience, and to give other facts which an extra six months' work has added to my knowledge of the subject.

My view of the question as it presents itself to us to-day is that for some time to come coal gas will form the main basis of our illuminating gases, and that we may profitably narrow the question of carburation to finding how best we can enrich a 15 or 16 candle power coal gas up to the standards required by the various corporations without the use of high-priced cannel coal

We may roughly classify the means at our disposal for this purpose into four divisions: (1) Carbureting the gas directly by charging it with the vapors of volatile hydrocarbons. (2) Enriching it by gases produced by the superheating of hydrocarbons which, under ordinary temperatures, would condense and form portions of the tar. (3) Increasing the illuminating value of poor coal gas by admixture with highly carbureted water gas. (4) Enrichment by admixture with gases obtained by cracking various grades of oil. Of the first of these methods, there is at present only one which practically interests the gas manager, although the patent literature of the last fifty years is strewn with the tombstones of many.

The Maxim-Clark process, which was introduced last year, has been extensively adopted by the South Metropolitan Gas Company, and is also under trial elsewhere with very satisfactory results; and this system undoubtedly has advantages which must not for one moment be underrated, as the apparatus is applied directly to the outlet of the gasholder, and gives the power of easily and quickly enriching a poor batch of gas, which could never be done by simply passing a rich gas into a gasholder containing poor gas, and expecting the two to mix by diffusion.

Since Mr. Frank Livesey last autumn read his paper upon this process before the Southern District Association of Gas Engineers and Managers, the quality of the light hydrocarbon used in the apparatus has been improved, by using a light petroleum spirit of constant composition, having a specific gravity of .680, and which is obtained at a price 30 per cent. less than that paid for the gasoline used in the earlier experiments. With gasoline at 1s. 2½d. per gallon, Mr. Livesey calculated the cost of enrichment at 1½d. per candle power per 1,000 cubic feet. This has now been reduced to a shade over 1d., while extended experience has shown that, by using a spirit of this gravity, there is practically no condensation during distribution. In this paper it will be convenient to adopt a standard of enrichment so as to better compare the cost of various systems; and I think the enrichment of a 16-candle gas up to an illuminating value of 17.5 candles will be the most useful one to take. By the Maxim-Clark process, this can be done at a cost of 1.64d.; but it must be remembered that the working of the apparatus is completely under control, while its cleanliness and the absence of tar, pitch, or soot, as residuals, is a great point in its favor.

The second method of carbureting, again, is represented by only one process—the Dinsmore; and I, like many others, am forced to confess that at the moment I am not sure of either the process or the results. The evidence at our disposal is of the most conflicting character; and I must ask you, therefore, to excuse me if, in the present state of my knowledge of the subject, I do not discuss it.

The enrichment of coal gas by carbureted water gas is undoubtedly one of the most important factors in the question, and requires very serious attention before sound conclusions concerning it can be arrived at. Several processes have been brought to this country during the past few years; and of these one has so far been adopted on a large scale. The Gas Light and Coke Company have erected two installations of the form of apparatus known as the "Improved Lowe" plant, which is the one most in use in the States, and which has the great advantage of being able, from its great superheating surface, to crack and convert into permanent gases many of the heavier grades of oil. This apparatus is one of the type in which the water gas is made by alternately raising the temperature of the fuel in the generator by means of an air blast, and then making the water gas by injecting superheated steam over the incandescent fuel; while the producer gas given off during the "blow" is utilized to heat up the cracking and superheating chambers, into which, during the subsequent operation, the water gas passes, and mingles with the vapors of hydrocarbons formed by allowing previously heated oil to flow on to the bricks of the cracking chamber—the vapors

being afterwards converted into permanent gases in their passage through the superheater.

The working of this apparatus at Beckton has, I believe, given complete satisfaction, and is capable of making a million cubic feet of gas per day with a consumption of 45 lbs. of coke per 1,000 cubic feet of gas; while an illuminating power of 29.5 candles has been obtained by the use of 4½ gallons per 1,000 cubic feet of Russian "distillate" oil, of .860 specific gravity, and a flashing point of 130° Fahr., which has a market value of about 3½d. per gallon.

Mr. Goulden, in a paper read before the Incorporated Institution of Gas Engineers last month, calculated the cost of the 29.5 candle gas at 1s. 8¼d. per 1,000 cubic feet in the holder; the items being as follows:

	s.	d.
Oil, 4.5 gallons at 3½d.	1	3¾
Coke, 45 lbs. at 12s. 6d. per ton	0	3
Purification	0	0½
Manufacturing wages	0	1
	1	8¼

The tar produced was calculated as equivalent to the steam, and the water used for condensing, scrubbing, etc. There is no doubt but that these figures, obtained in practice at one of the largest works in the world, will cause a strong feeling in favor of carbureted water gas in every gas manager's mind, as it means a ready way of enrichment, almost complete control of the labor question, and freedom from the harrassing cares of foggy days and other unexpected causes of suddenly increased consumption. The improved Lowe plant is undoubtedly the best of the type of exterior superheater apparatus, of which there are many examples to be found in the States; and as Mr. Goulden says that, to the best of his belief, it is not patented in this country, this will be another point in its favor with the English gas manager.

From a chemist's point of view, there is no doubt but that the plant exhibited in this country for a short time, and known as the Van Steenbergh system, was distinctly an advance on the Lowe process; as the red hot carbon in the generator was used to crack lighter grades of American and Russian oil, and the interactions taking place under the surface influence of the incandescent carbon between the nascent hydrocarbons and water gas, not only reduced the percentage of carbon monoxide 8 or 10 per cent., but also increased the amount of illuminants present in the gas, so that a 22 candle gas was obtained from 2½ gallons of light grade oil. It is useless, however, to further refer to this process, as the absence of the inventor from this country at the most critical period for demonstrating the utility of his system, and the general opinion that the troubles surrounding the carriage and storage of the right grade of oil, on account of its low flashing point, are insurmountable, have practically relegated this process for the present to those shadowy depths which, in the last few years, have swallowed up so many others. I only hope Mr. Van Steenbergh may, as he promises, return to this country at a later date, to show how the objections raised may be overcome; in which case his process will be worthy of serious consideration.

At present we may assume that the Lowe plant will be the representative water gas process adopted in this country, and that, taking into consideration variations in the price of fuel and oil, carriage, etc., its cost to the gas manager will be 1s. 6d. to 1s. 8d. per 1,000 cubic feet of 25-candle gas; which means that the enrichment of a 16-candle gas to the required 17.5 standard will cost 1.01d. per 1,000 cubic feet. These figures are by far the best yet obtained in working practice; and we have now to confront the problem of how far it may be possible to improve upon them. The use of highly carbureted water gas as an enriching medium of necessity means an increase of carbon monoxide in the gas distributed to the consumer. Although there is no legislation on the subject, yet if I were a gas manager, I should certainly fix in my own mind 10 per cent. of this most poisonous gas as an outside limit; while the lower it can be kept, the better. If it is as easy and as cheap to enrich the gas, and yet to keep the monoxide down to 4 or 5 per cent., it is certainly better to do so. In carbureted water gas it is, in reality, nothing but diluted oil gas which is giving the illuminating power; so that the question narrows itself to how we are to obtain the highest illuminating results from such oils as are obtainable at a reasonable price. So far, we may take the results given by the Maxim-Clark and Lowe processes as the best obtainable by the methods they represent; and we can now consider the possibility of carbureting by oil gas pure and simple.

There are many methods and forms of apparatus for the production of oil gas; and for some years, the well known Pintsch system of making and compressing oil gas has easily held its own, and may be looked upon as the best worked out process in use. The oil used is the first residue of Scotch shale oil, after the paraffine wax has been abstracted. It has a specific gravity of .860 to .875, with a flashing point of 250° Fahr.; and it costs about 5d. per gallon. This oil is converted into gas in a double retort; the oil trickling into the upper chamber, where it is volatilized on a movable tray. The vapors then pass into a lower chamber, and are cracked into permanent gases at a cherry-red heat. As a rule, 11 gallons of oil yield 1,000 cubic feet of from 50 to 60 candle power gas; and this is compressed at about 140 lbs., on the square inch, which causes the separation of about a gallon per 1,000 cubic feet of a volatile liquid consisting chiefly of benzene, anylene, and toulene, and this reduces the illuminating value to about 40 candles. Taking the gas as cracked, and before compression, and allowing for the value of residuals, it will cost at least 5s. per 1,000 cubic feet; and if the gas were used directly for enriching coal gas, the cost of increasing 16 candle gas to the 17.5-candle standard would be 3.64d. per 1,000 cubic feet.

In a very valuable paper read before the May meeting of the Incorporated Institution of Gas Engineers, Mr. Foulis states that the usual yield of oil gas, as made by the various companies, is 76.6 cubic feet per gallon of 62-candle gas; and this is certainly the limit obtainable by the ordinary methods. By forcing the temperature, a higher yield may be obtained; but every increase in volume means a breaking down of the higher hydrocarbons into simpler compounds, and a corresponding decrease in illuminating value. Oils to give 80 cubic feet of 62 candle gas may, Mr. Foulis says, at present be purchased at £3 6s. 3d. per ton, or about 3d. a gallon; and the cost of labor and fuel, and charges on wear and tear of plant, would bring such gas, at the lowest computation, up to at least 4s. per 1,000 cubic feet, at which price the enrichment would cost 2.34d. to bring a 16-candle gas up to an illuminating value of 17.5 candles. Dr. L. T. Thorne presented a paper last year to The Gas Institute on "Oxygenated Oil Gas," as made by the Tatham process, and gives the following figures: He finds that an illuminating gas having 8.5 times the candle power of London gas—*i. e.*, $8.5 \times 16 = 136$ candle power—can be made by retorting crude petroleum or shale oil at a low temperature, and mixing it with 15 per cent. of oxygen, which causes the otherwise smoky gas to burn with a bright white flame, having this very high illuminating value, and also prevents deposition from the gas of the hydrocarbon vapors; and he calculates that the cost of such a gas should not exceed 3s. to 3s. 6d. in the holder. Taking the cost of 1,000 cubic feet at the higher of these figures, the cost of increasing the illuminating value from 16 to 17.5 candle power would come out at 0.105d. These figures are so truly remarkable, that, coming as they do from one of our most careful scientific observers, they must command grave attention; as, if the figures be even approximately correct, they mark the most important advance yet made in the enrichment of coal gas.

I have been making some experiments on this subject lately, but I have not at present been able to obtain results at all equal to those claimed for the process. My trouble has been, not in the increase of illuminating power given by the admixture of oxygen, but in obtaining the volume per gallon of oil gas of the illuminating value which that mentioned by Dr. Thorne yielded. In his paper, he infers that the oxy-oil gas has an illuminating value of 136 candles; and his experiments show that the increase due to admixture with oxygen is nearly 20 per cent. So that the original oil gas must have had an illuminating value of about 109 candles; and his calculations as to cost are based on making 22,000 cubic feet of this oil gas per ton of crude or refuse petroleum at 55s. per ton. The various crude petroleums run from .780 to .970 specific gravity, so that 280 gallons per ton would be an outside figure to allow, which means that 78 cubic feet of gas per gallon was obtained; and I must admit that I have been unable to get anything approaching 78 cubic feet of 109-candle gas, even from refined oils.

The following figures may be taken as representing the ordinary results obtainable by retorting various oils:

Oils.	Specific Gravity.	Flashing Point.	Gallons per Ton.	Gas.	Candle Power.
Crude shale paraffine	.850	92° Fahr.	263	98 cub. ft.	50
Green oil (from shale paraffine)	.884	165° "	253	102 "	53
Twice-run oil	.802	67° "	279	108 "	70
Ordinary American paraffine	.799	84° "	280	86 "	66
Russian crude	—	—	—	90 "	61
Russian distillate	.864	135° "	259	84 "	56

So that Mr. Foulis's figures of 82 cubic feet of 62-candle gas may be accepted as a good yield from any oil obtainable at a cheap rate. It will be objected that these figures cannot be taken into account in considering oxy-oil gas, as the inventor specially insists upon the oils being retorted at a very low temperature. But it must not be forgotten that,

although by doing this a heavy smoky gas, of very high illuminating value, is obtained, which gives a greater increase in luminosity with the oxygen, yet that the volume obtained is very much smaller, while the quantities of residuals rapidly increase and hamper the working.

As an example of this, I may give the cracking of a medium oil at a very dull red heat and at a bright red :

	Dull Red.	Cherry Red.
Cubic feet of gas per gallon....	64	128
Candle power.....	56.4	28
Residuals per gallon....	4 pints	1.54 pints.
Analysis of the gases—		
Carbon dioxide.....	1.27	1.33
Oxygen.....	1.89	1.33
Ethylene series....	36.02	5.32
Carbon monoxide	0.63	1.83
Methane series.....	41.30	23.22
Hydrogen.....	18.89	68.47
Nitrogen	nil	nil
	100.00	100.00

While the same oil cracked at an intermediate temperature (orange red) gave 80 feet per gallon of 44-candle gas.

If we now calculate from those figures the total candle power per gallon of oil obtained at these temperatures, we find that the total value varies but little within certain limits :

Temperature.	Total Candle Power per Gallon.
Dull red.....	733.0
Orange	704.0
Cherry.....	716.8

The 28-candle power gas, however, would only bear with advantage the admixture of 2 per cent. of oxygen, while a much larger proportion might be added to the 56 candle power gas to obtain the maximum result ; while the smokier and richer the oil gas, the higher will be the illuminating value of the oxy-oil gas made from it, and the smaller the yield of gas per gallon of oil.

There is no doubt but that the addition of oxygen in the right proportion to a warm, heavy, oil gas, not only gives it a great carrying power, but also increases the illuminating value from 15 to 20 per cent.; and even with a rich carbureted water gas, I should expect the same beneficial results, although to a smaller extent. I am at the present moment experimenting very fully with the question of mixing oxygen with rich gases, and hope to have some very important results to bring before you shortly ; but in the meantime we may assume that we start, with an oil gas of 62 candle power, at 4s. per 1,000 cubic feet, and mix with this 10 per cent. of oxygen at 2s. 9d. per 1,000 cubic feet, obtaining 1,100 cubic feet of 74 candle power gas at a cost of 4s. 3.3d., or a shade over 3s. 10½d. per 1,000 cubic feet. Five cubic feet of this are equal to 74 candles ; so that keeping it at a value of 17.5 candles, there will be 56.5 candle power available for enrichment, which will raise 188 cubic feet of 16 candle gas to the 17.5 candle standard. In other words, a mixture of 974 cubic feet of 16 candle power gas with 26 cubic feet of oxy-oil gas, will give 1,000 cubic feet of gas with an illuminating value, of 17.5 candles. 974 cubic feet of 16-candle gas at 1s., and 26 cubic feet of oxy-oil gas at 3s. 11d., are equal to 1,000 cubic feet of 17.5-candle gas at 12.9d., or a shade under 1s. 1d.; so that the enrichment has in this case cost slightly under 1d. per 1,000 cubic feet. I think this will be found nearer to the practical working price than the figures deducible from Dr. Thorne's paper ; but, at the same time, I freely admit that my experiments give me great hope of being able to lower this figure. At present I prefer to adopt the basis laid down by Mr. Foulis, who is recognized by the gas world as a gentleman having probably as great a knowledge of practical oil gas making as any manager in the kingdom ; and I am also of opinion that, although the use of crude and refuse oils are advocated as the source from which to obtain the rich oil gas, this will never be adopted in practice, as with a Russian distillate oil of the grade and price now being employed at Beckton, it would never be profitable to use a crude oil with its attendant drawbacks of soot, pitch and sulphur.

Collecting the results of the cost of enrichment, we can tabulate them as follows :

Cost of Enriching a 16*-Candle Power Coal Gas up to* 17.5 *Candles.*

By Cannel.....	4.00d. per 1,000 cub. ft.
" Pintsch gas.....	3.64d. "
" Oil gas (Foulis).	2.34d. "
" Maxim-Clark.....	1.64d. "
" Carbureted water gas.....	1.01d. per 1,000 cub. ft.
" Tatham (probable).....	0.91d. "
" " (claimed)..... ...	0.10d. "

So that supposing no better results can be obtained than my imperfect experiments at present indicate, the Tatham process is still well worthy of careful consideration, as it has an advantage, although not a big one, over carbureted water gas in price, and reduces rather than increases the percentage of carbon monoxide present in the gas.

In discussing this question, all side issues should be brought to light. It must not be forgotten that this oxy-oil gas will stand far rougher treatment than a rich cannel gas, and the admixture of it with coal gas before the purification would help to bring about the same results as obtained in the beautiful process perfected by Mr. Valon ; while I think I shall be able to show you, at a later date, that the hydrocarbons escaping as residuals during the retorting have a higher value than coal tar, and will in this way tend to reduce the cost of the process.

In conclusion, I will express the opinion that at the present moment the Tatham process, when got into practical working form, looks the most hopeful for continuous work, while no more valuable auxiliary for intermittent use could be found than the Maxim-Clark.

Some Dangers in Electric Lighting.

[A "note" contributed by Mr. Wm. McDevitt, Inspector of the Philadelphia Board of Fire Underwriters, to the proceedings of the Franklin Institute.]

After several years of experience in noting the dangers occurring in the use of electric lighting, it has been clearly demonstrated that in nearly every case the accidents resulted through ignorance both on the part of the workmen engaged in installing the wires and the lessee to whose care the new apparatus was entrusted.

These practical illustrations served as valuable lessons to those who witnessed them, more especially to the workmen, whose education in the business consisted merely in following plans laid out by the contractor.

Although the introduction of electric lighting has rapidly increased in our city, its use has been comparatively free from accidents, proving that most of the inherent dangers have been controlled, leaving but few features that require the attention of inventive minds to overcome. The most important of the existing defects is that relating to fusible connections, as the innumerable variety of alloys used for fuse metal is very misleading and is still an element of danger. Some of these compositions possess the properties of good electrical conductivity and are slow to heat ; other compositions are of a character exhibiting weakness when heated, resulting in annoyance from continuous breaks and offering temptations (as has been found) to use ordinary wire in the absence of proper fuses.

Another universal danger in electric lighting results from the want of some uniform or more ready method of perfecting splices or joints in conductors. Some workmen are in the habit of making loose copper unions, leaving the solidity of the joint dependent on solder, which, being a metallic cement, is liable to be fused by a possible heavy short-circuit occurring on the line, thus melting the solder and leaving a loose connection.

Probably the most alarming danger exists through the possibility of lightning being conducted into houses lighted by electricity where the latter is supplied by aerial wires. The existence of this danger has been demonstrated where the house wires are attached to gas fixtures, offering a ready path for the lightning, which, in leaping from the charged wires to the gas pipes, carries the electric light current across, forming an arc, which pierces the pipe, and where gas is present, it will be ignited, causing a steady blaze. If this accident should occur near the ceiling, the building would be endangered.

With the rapid introduction of new appliances in electrical science, it may reasonably be expected that the defects above-mentioned will be overcome in the near future.

The Blackening of Incandescent Lamps.

By Mr. L. S. Powell.

The references which have lately appeared in the London *Electrical Review* relative to the depreciation in the illuminating power of incandescent lamps through blackening, and its consequent bearing on the economic length of time that lamps should be kept in use, have a peculiar interest to those who have made this department of electric lighting a

special study. The tables given on page 621 of the *Review* for May 15th show clearly the different degrees of darkening tendency which lamps of different manufacture possess. It is not forgotten that other causes besides blackening contribute to diminish the illuminating power, but in most lamps, at least, the one under consideration is the most influential. To the manufacturer of lamps, then, this blackening feature is naturally one of the utmost importance, since in this direction lies one of the principal possibilities for further improvement. Formerly the writer was of opinion that the problem of diminishing this blackening tendency was about on a par with that of attempting to prevent water from boiling when a kettle of it is placed over a fire. But the two cases are scarcely parallel, for it is an undeniable fact that blackening occurs in very different degrees, not only in lamps of different manufacture, but even among their own kind. A good deal of the variation, no doubt, occurs through differences in the temperature of the respective filaments, but this cause is certainly not the only one at work. Much of the difference is attributable to the manner in which the carbon filament has been treated during its manufacture, and this fact raises the very interesting inquiry as to what cause the blackening is due, and wherefore there should be these differences in intensity.

To the writer there appear to be two possible explanations to account for the blackening phenomenon: One is the generally accepted view of the vaporization and sublimation on the glass of carbon, pure and simple: the other, that the obscuring substance may possibly not be pure carbon but a hydro-carbon, or some allied carbon compound.

Probably every lamp manufacturer is familiar with the fact that lamps made with filaments which have been "baked" at a comparatively low temperature blacken very readily indeed, while when made with others which have been raised to a very high temperature, they resist the tendency very much more effectually. Further, that the same results occur in lamps when low or high temperature flashing has been employed. He is also very familiar with the effect of different temperatures on the hardness of the resulting carbon. If then the vaporization of pure carbon be the true explanation of the darkening of lamp bulbs, it follows that the difference in degree must arise solely from the circumstance that a comparatively loose condition of the carbon is especially favorable to the formation of carbon vapor. But the production of carbon at a low temperature would also be especially favorable to blackening, if the hydro-carbon view is the correct one. The writer can well remember when attending Dr. Frankland's lectures on chemistry, being impressed by that gentleman's assertion that to produce pure carbon by any of the usual methods is almost an impossibility, and that to free it from the ever present combined hydrogen, it is necessary to heat it in chlorine gas for days. That all hydro carbon compounds are eliminated from the filaments in ordinary use is, therefore, extremely doubtful. In further support of the view that the presence of hydrogen may exert an influence in the feature of blackening, the fact may be cited that filaments of carbon baked at a low temperature become materially harder in process of running lamps made with them, and yet the rate of blackening, instead of diminishing, seems to proceed at an accelerating rate. It would be most interesting if those who have the opportunity would collect and thoroughly examine the composition of the deposit which collects on lamp bulbs, and thus throw valuable light on this interesting subject, and in addition, direct the steps of the pioneer lamp manufacturer into a track which is likely to lead to a material decrease in this unfortunate property of lamps. To carry out the work satisfactorily, it would be necessary to examine the deposit obtained from lamps from various sources, and then, should it prove to be other than pure carbon, to further ascertain, if possible, the treatment the respective filaments have been subjected to. The latter undertaking would, probably, be the more difficult of the two, considering the commercial interests at stake. It may be mentioned that the obscuring film is readily removed from the glass by means of a little warm caustic soda solution. Also the fact that the film is a sufficiently good conductor of electricity, even when faint, to become coated with copper when a piece of the glass is made the cathode in a copper plating bath. It is possibly due to this fact that an incandescent lamp acts as such an excellent condenser.

It is interesting to speculate as to how the obscuring matter, whatever it may be, finds its way from the filament to the glass. It is conceivable that there may be three methods by which the transfer can be effected: Firstly, by the direct formation of a vapor, as in the case of the vaporization and sublimation of arsenic; secondly, by the solution to saturation of the matter in the residual gas and subsequent precipitation therefrom on the neighboring cold surface, as instanced by the solution of water in warm air and its re-appearance on a window or other cool surface; thirdly, by the mechanical emission of solid particles. From a consideration of specimens of blackened lamps, it is difficult to determine which of these methods is the true one, or whether two or more methods combine to effect the transfer, because, in vacuo, the conditions of matter are so materially altered in so many essential details from those with which we are ordinarily familiar that arguing by analogy becomes impossible. But whether the transfer is effected by gaseous or solid particles, we may note certain very significant effects. The sharply defined uninterrupted circular line of slightly tinted glass, so distinctly visible by daylight in every well blackened lamp whose Π-shaped filament is perfectly symmetrical, tells a peculiarly interesting tale. There can be no doubt that this half-colored line is caused by the limb of the filament nearest the glass acting as a screen to the emissions of the more distant one. In other words, the projected particles of only one of the limbs can strike against the light colored strip, because just there the further one is hidden, whereas in every other part of the bulb they can, and do, strike from both limbs, and consequently at all these other parts the glass is colored to twice the depth of the screened portion. Another notable effect is that of the patchy, unequal blackening which occurs in the bulb of a lamp whose filament develops a bright spot, the glass in the neighborhood of the spot being the darkest part. The same thing happens when the filament is bent so as to stand appreciably out of the center of the bulb. From these observations it is perfectly clear that the matter, whether in the form of vapor or solid, is in the radiant condition, and that there is no turning of corners for it. The particles fly direct from the filament to the glass and there adhere to it and to one another as firmly as do the particles of copper on the cathode of an electro plating arrangement; and further, they appear to follow the same law as light, in its property to decrease in intensity with the distance from the issuing point. It naturally follows from this consideration that for a given size of filament, the larger the bulb the less the amount of blackening, other considerations remaining the same.

As regards the remarkably coherent black film, it may be remarked that if it is built up by the accumulation of countless solid particles it would entail that carbon is possessed of far more of the soft, doughy property of lead or wax than one is apt to attribute to it. The principal causes assisting to bring about the cohesion, assuming this view to be correct, are, no doubt, the probable enormous velocity with which the particles travel, and the freedom from any foreign matter acting to interfere with the intimate contact of such particles as they collect.

Referring to the economic length of run that a lamp should have, it seems to the writer that any particular number of hours arrived at by calculation, can only hold good in a general sense, for the reason that lamps do not all blacken equally in the same time. Probably the actual run that lamps will have, in private houses at any rate, will be determined by the inconvenience experienced from an insufficiency of light rather than by any other consideration.

Text of the Bill to Enable Municipalities in Massachusetts to Distribute Gas and Electricity.

The following is the complete text of the act (passed at the last session of the Massachusetts Legislature) enabling the authorities of the cities and towns of that State to manufacture and distribute gas and electricity:

SECTION 1. Any city or town may, under the limitations of this act, construct, purchase, lease or establish and maintain within its limits one or more plants for the manufacture or distribution of gas or electricity for furnishing light for municipal use, and for the use of such of its inhabitants as may require and pay for the same as herein provided. Such plants may include suitable land, structures, easements, water privileges, stations, gasometers, boilers, engines, dynamos, tools, machinery, pipes, conduits, poles, conductors, burners, lamps and other apparatus and appliances for making, generating, distributing and using gas or electricity for lighting purposes.

SEC. 2. No city shall exercise the authority conferred in section 1 until a vote that it is expedient to exercise such authority shall have passed each branch of its City Council by a two-thirds vote and received the approval of the Mayor in each of two consecutive municipal years, and thereafter have been ratified by a majority of the voters present and voting thereon at an annual municipal election. When such a vote has failed to secure such ratification no similar vote shall be submitted for ratification until after the expiration of five years thereafter.

SEC. 3. No town shall exercise the authority conferred in section 1 until after a vote that it is expedient to exercise such authority shall have been passed by a vote of not less than two-thirds of the voters present and voting at each of two legal town meetings duly called for the purpose, of which meetings the second shall be held at an interval of not

less than two nor more than thirteen months after the first. At such meetings such vote shall be taken by written or printed ballot and by the use of the check list. When such a vote has failed of passage as hereinbefore provided at the second of said meetings, no similar vote shall be passed until after the expiration of two years thereafter.

SEC. 4. Any city or town establishing or purchasing a plant within its limits as provided in this act, or reconstructing, extending or enlarging the same, as provided in section 5, may pay for the same by the issue of bonds, payable in a term not exceeding 30 years and bearing interest at a rate not exceeding 5 per cent., which shall not be disposed of for less than par and accrued interest, and the indebtedness thereby created shall not be included in the limit of indebtedness of such city or town provided by law; but such bonds shall not be issued until a vote authorizing the same has been passed by the vote required by section 7 of chapter 29 of the Public Statutes, and the whole amount of bonds so issued by a city or town, and outstanding, shall not exceed at their par value the amount of 5 per cent. of the total valuation of estates therein in the case of a town, or 2½ per cent. of such valuation in the case of a city, according to the last preceding State valuation. The interest on such bonds and a sinking fund to meet the same at maturity shall be provided for as required by section 9 of said chapter 29. No indebtedness shall be incurred by any city or town in connection with such plant except as aforesaid, and excepting further that money may be borrowed under the provisions of section 6 of said chapter 29 as amended, to pay the operating expenses thereof. All receipts from the sale of gas or electricity shall be paid over to the treasurer of such city or town. The gross expenses of running such plant and conducting such business of supplying gas or electric light, including interest on such bonds and requirements of the sinking fund as aforesaid, shall be included in the appropriations made annually or from time to time by such city or town, and shall be paid out of the treasury thereof.

SEC. 5. Any city or town owning a plant for the manufacture or distribution of gas or electricity may reconstruct, extend or enlarge the same, but no such reconstruction, extension or enlargement, beyond the necessary and ordinary maintenance, repair and replacement thereof, except such increased appliances for the distribution of gas and electricity as may be necessary to furnish the same to new takers, shall be undertaken or made except by the vote provided by section 4 in case of the issue of bonds.

SEC. 6. Any city or town obtaining a plant may provide by ordinance, if a city, or by by-laws, if a town, for the equitable assessment upon the owner or occupant of any premises of any part or the whole of the cost of laying and maintaining upon such premises, pipes, conduits, conductors or other appliances for the distribution of gas or electricity to the occupants thereof. Payment of such assessments shall not be obligatory, but shall be made a condition precedent to the supply of gas or electricity to the occupants of such premises, and may be exacted before providing any such appliances for such distribution.

SEC. 7. Any city or town having obtained a plant for the purpose, as provided in this act, may manufacture, generate and distribute gas or electricity for furnishing light for municipal use or for the use of its inhabitants, under such regulations as it may establish. No city or town shall be compelled to furnish gas or electricity to any person or corporation except upon order of the gas and electric light commissioners, and after the payment of any assessment provided for in section 6. Any person or corporation aggrieved by the refusal of any city or town supplying gas or electricity under the authority of this act to furnish the same may appeal to such commissioners, setting forth in such appeal what is required of the city or town, in such detail as the commissioners may require.

SEC. 8. Whenever any city or town shall obtain a plant as provided in section 1, the operation, control, management and repair thereof, the manufacture, generation and distribution of gas and electricity thereby, including the purchase of supplies, the hiring and discharge of employees, and all business relating to such manufacture, generation and distribution, to the methods, amounts, times, prices and quality of the supply to each person and corporation, the collection of bills, the keeping of accounts and custody of moneys received for gas or electricity or otherwise, and the payment of bills incurred in said business, shall be entrusted, subject to any ordinances established by the city council in a city, or the bye-laws or regulations established in a town, to one officer, who shall be appointed and may be removed by the mayor in a city, and by the selectmen in a town. Such officer shall be known as manager of gas, manager of electric light, or manager of gas and electric light, according as a plant for one or both may be under his charge. In cities the compensation of such officer shall be annually fixed by the city council, and in towns by the selectmen. Before entering upon the duties of his office he shall give bond to the city or town for the faithful performance of his duties in such sum and form and with such sureties as the mayor or selectmen shall approve. He shall at the end of each municipal year render to the mayor or selectmen such detailed statement of his doings and of the business and financial matters in his charge as the gas and electric light commissioners may prescribe. He shall also, at any time when required by the mayor or selectmen, make to him or them a statement of his doings, business, receipts, disbursements, balances, and of the indebtedness of the city or town in his department, in the detail required; and he shall pay over to the treasurer of the city or town all receipts collected.

SEC. 9. The books and accounts pertaining to the business authorized by this act shall be kept in a form to be prescribed by the board of gas and electric light commissioners, and the accounts shall be closed on the 30th day of June in each year so that a balance sheet of that date can be taken therefrom and included in the return to said board, which return shall be for the year ending the 30th day of June. The mayor or selectmen and manager shall annually on or before the second Wednesday of September in each year, make a return to said board in a form prescribed by it, setting forth the financial condition of said business, the amount of indebtedness authorized or existing on account thereof, a statement of income and expenses in such detail as the board may require, with a list of salaried officers employed in said business and the amount of salary paid to each. Said return shall be signed and sworn to by the mayor or a majority of the selectmen, and in both cities and towns by the manager. The mayor of a city or the selectmen of a town may direct, in addition, any additional returns to be made at such time and in such detail as they may order. The mayor or selectmen and manager shall also at all times, on request, submit said books and accounts for the inspection of said board, and furnish any statement or information required by the board concerning the condition, management and operation of said business.

SEC. 10. The price to be charged for gas or electricity to persons and corporations shall be fixed, and shall not be changed oftener than once in three months. Any change shall take effect on the 1st day of a month, and the new price adopted shall, before the change shall take effect, be advertised in some newspaper published in the city or town where the plant is, if any is published therein. Such price shall not, except with the written consent of the gas and electric light commissioners, be fixed at less than cost, in which shall be included in addition to all operating expenses, interest on the net investment in plant made by the city or town, less assessments collected under section 6, at the rate paid upon the bonds above provided for, together with the requirements of the sinking fund established to meet such bonds, and also depreciation of the plant, to be reckoned at not less than 5 per cent. per annum of its cost, and losses; but any losses exceeding 3 per cent. of the investment in plant may be charged in different years at not more than such 3 per cent. per annum. Such price shall not be greater than shall allow above such cost a profit of 8 per cent. per annum to the city or town upon its net investment. In fixing such cost to establish the price to be charged to persons and corporations the gas and electricity used by the city or town shall be charged to it at cost. A sufficient deposit to secure the payment for gas or electricity for three months may be required in advance from any taker, and the supply may be shut off from any premises until all arrearages for gas or electricity furnished thereon, to whomsoever furnished, shall be paid. After three months default in the payment of such arrearages all appliances for distribution belonging to the city or town on such premises may be removed, and after such removal shall not be restored except on payment of all such arrearages, and a sufficient sum to cover all expenses caused by removal and restoration.

SEC. 11. Any city operationg a plant under this act may pass ordinances, and any town operating a plant under this act may, subject to the approval of the superior court, adopt by-laws imposing penalties not exceeding $50 to protect its plant, control its use, prevent accidents from gas or electricity supplied by such city or town, and govern consumers in the use thereof.

SEC. 12. When any city or town shall decide as hereinbefore provided to establish a plant, and any person, firm or corporation shall at the time of the first vote required for such decision be engaged in the business of making, generating or distributing gas or electricity for sale for lighting purposes in such city or town, such city or town shall, if such person, firm or corporation shall elect to sell and shall comply with the provisions of this act, purchase of such person, firm or corporation before establishing a public plant such portion of his, their or its gas or electric plant and property suitable and used for such business in connection therewith as lies within the limits of such city or town. If in such city or town a single corporation owns or operates both a gas plant

and an electric plant, such purchase shall include both of such plants, but otherwise such city or town shall only be obliged to purchase the existing gas plant or plants if it has voted only to establish a gas plant, and shall only be obliged to purchase the existing electric plant or plants if it has only voted to establish an electric plant. If the main gas works, in the case of a gas plant, or the central lignting station, in the case of an electric light plant, lie within the limits of the city or town which has voted to established a plant as aforesaid, such city or town shall purchase as herein provided the whole of such plant and property used in connection therewith, lying within its limits, and the price to be paid therefor shall be its fair market value for the purposes of its use, no portion of such plant to be estimated, however, at less than its fair market value for any other purpose, including, as an element of value, the earning capacity of such plant based upon the actual earnings being derived from such use at the time of the final vote of such city or town to establish a plant, and also any locations or similar rights acquired from private persons in connection therewith, plus the damages suffered by the severance of any portion of such plant lying outside of the limits of such city or town, and minus the amount of any mortgage or other encumbrance or lien to which the plant so purchased, or any part thereof may be subject at the time of transfer of title; but such city or town may require that such plant and property be transferred to it free and clear from any mortgage or lien, unless the commissioners appointed under the provisions of section 13 of this act shall otherwise determine. Such value shall be estimated without enhancement on account of future earning capacity, or good will, or of exclusive privileges derived from rights in the public streets. When any capital has been paid in, in property instead of in cash, the valuation placed upon such property in estimating it as paid in capital shall not be conclusive in estimating its value under the foregoing provisions, but may be disputed by a city or town, and if shown to have been excessive may be reduced by the authority fixing the price of the plant and property as hereinafter provided. If the main gas works or central lighting station of such a plant do not lie within the limits of the city or town which has voted as aforesaid, then such city or town shall only purchase that portion of such plant and property which lies within its limits, paying therefor upon the basis of value above established, but without allowance of damages on account of severance of plant. No city or town shall be obligated by this section to buy any apparatus or appliances covered by letters patent of the United States or embodying a patentable invention unless a complete right to use the same and all other apparatus or appliance necessary for such use within the limits of such city or town to such extent as such city or town shall reasonably require such right, shall be assigned or granted to such city or town at a cost as low as the cost of such right would be to the person, firm or corporation whose plant is purchased.

SEC. 13. Any person, firm or corporation desiring to enforce the obligation of any city or town under section 12 to purchase any property shall file with the clerk of such city or town, within 30 days after the passage of the final vote whereby such city or town shall have decided to establish a plant, a detailed schedule describing such property and stating the terms of sale proposed. If the parties fail to agree as to what shall be sold, or what the terms of sale and delivery in accordance with the provisions of this act shall be, either party may within 60 days after the filing of the schedule apply by petition to the supreme judicial court, or any justice thereof, setting forth the facts and praying an adjudication between the parties, and thereafter such court or justice shall, after giving both parties an opportunity to be heard, appoint a special commissioner or commissioners, who shall give the parties an opportunity to be heard, and shall thereafter adjudicate what property, real or personal, including rights and easements, shall be sold by the one and purchased by the other, in accordance with the provisions of this act, and what the price, time and other conditions of the sale and delivery thereof shall be. Such commissioner or commissioners shall file his or their award in the supreme judicial court for revision or confirmation by said court.

SEC. 14. Any party aggrieved by the award of the commissioner or commissioners may within fourteen days after its filing, or within such longer time as the court may allow, file objection thereto, and apply to the court for a hearing on such award relative to any matter of fact or law pertaining to the same, and thereupon the court shall order a trial to be had before said court or a justice thereof, after due notice to all parties interested in the matter of said award, in the manner of hearings in equity. The decree of the court upon said award shall be final and binding, and said court shall have jurisdiction in equity to compel compliance therewith, and may also issue and enforce such interlocutory decrees and orders as justice may require.

SEC. 15. Whenever the existing gas plant or electric plant of any person or corporation shall have been acquired by any city or town pursuant to the provisions of this act, the powers and rights of such person or corporation in relation to the manufacture and distribution of gas or electricity within the limits of such city or town shall, from and after the date of such acquirement, cease and determine.

SEC. 16. Any city or town owning or operating a plant or plants for the manufacture or distribution of gas or electricity for furnishing light under this act, shall be responsible for any injury or damage to persons or property, happening or arising by reason of the maintenance or operation of the same, in the same manner and to the same extent as though the same were owned and operated by an individual or private corporation; but nothing in this act shall be constructed to include damages to any existing gas or electric plant in a city or town, by reason of the establishment of a competing line or plant under authority of this act.

SEC. 17. All general laws of the Commonwealth, and all ordinances or by-laws of any city or town availing itself of the provisions of this act, relative to the manufacture, use, generation or distribution of gas or electricity, or the quality thereof, or plant or the appliances therefor, shall apply to such city or town, so far as the same may be applicable and not inconsistent with this act, in the same manner as the same apply to persons and corporations engaged in making generating or distributing gas or electricity therein.

SEC. 18. Nothing herein shall be construed to take away, restrict or impair any rights of any city, town or other authority which may now exist to revoke locations of wires, poles, conduits or pipes, in, over or under their streets or ways; provided, however, that no city or town having within its limits the main gas works, in the case of a gas plant, or the central lighting station, in the case of an electric light plant, or the major portion of the wires, poles, conduits or pipes used in connection with any such works or plants, shall, except for a violation of the terms or conditions upon which the same were granted or for a violation of law respecting the exercise thereof, revoke any rights heretofore granted, or which may hereafter be granted, to any person or corporation engaged in the business of making, generating or distributing gas or electricity for sale for lighting purposes, after the first passage by the city council, in the case of a city of the vote provided for by section 2, or while such vote is pending in either branch thereof, or in the case of a town after the passage of the first vote provided for in section 3, or after the calling of a town meeting, at which the passage of such vote is included in the warrant; provided, however, that in case in either a city or town the second vote provided for by this act shall fail of passage or in a city shall fail to receive the approval of the mayor or the ratification of the voters in accordance with this act, then such city or town may exercise all rights of revocation, if any, which it possessed prior to the passage of such first vote until such first vote is again passed, or pending, or included in the warrants as above provided. And after the passage and ratification of both votes as provided in section 2, by a city, and after a passage of both votes as provided by section 3, by a town, no such city or town shall, except as hereinbefore provided, revoke any rights, locations or licenses granted to any such person or corporation. The provisions of this section shall apply in the case of a city, whether such revocation shall be made by both branches of the city government or by either branch thereof.

Mounting Drawings.

A writer in the *Carpenter and Builder* remarks that, in mounting drawings, to begin with a paste of good quality is required. When paste is made at home, trouble often arises from scorching, or from the addition of too much water. Thoroughly made paste, when spread on paper, will not strike through, but will remain on the surface like butter on a piece of bread. To enable the paste to keep for several months in a cool place, add dissolved alum as a preservative, in the proportion of a tablespoonful of pulverized alum in two quarts of warm or hot water.

Put the water in a tin pail that will hold 6 or 8 quarts, as the flour, of which the paste is made, expands greatly while it is boiling. As soon as the water has cooled stir in good rye or wheat flour until the liquid has the consistency of cream. Beat thoroughly with a paddle-shaped stick, and see that every lump is crushed before placing the vessel over the fire. Care should be exercised to have the water cool before adding the flour, otherwise the paste will be lumpy.

To prevent scorching the paste, place on the fire a pot or kettle partly filled with water, and set the pail containing the paste materials in the water, permitting the bottom to rest on a few large pebbles to prevent excessive heat. Of course, a "farina kettle," or "double boiler," is bet-

ter, and will be less troublesome to handle; but the "ruling element" of the kitchen will not always permit its use. Add a teaspoonful of powdered resin, a few cloves tied in a cloth, so that they will flavor and not discolor the paste, let it cook until it assumes the consistency of "mush," then, if any lumps appear, strain through a sieve. Keep in a tight jar, and if it becomes too thick after standing put the quantity required in a suitable dish, and thin by adding cold water and stirring thoroughly.

So much for the paste. Now let us proceed to the mounting. Cut the cloth from one inch to two inches larger all around than the drawing or paper to be mounted. Lay it on a drawing board or table, damp well with a sponge, stretch lightly, and tack down; use small tacks, and place them 4 or 5 inches apart, or closer if necessary.

Leaving it for a moment, and while its surface is evaporating and absorbing the surplus dampness, lay the drawing, map, or paper to be mounted face downward on another table, and dampen the back with a wet sponge. Returning to the cloth, with a brush (a large, round, fine-haired paint brush is best), lay the paste on evenly and smoothly, and then, after the surface is well covered, take the brush and beat the paste thoroughly into the pores of the cloth. After this is done smooth the surface nicely.

Take up the paper by the corners, and, if the thickness of the paper seems to require it, apply the sponge again. The paper should be limp, but not wet. If it is not well prepared, my experience has been that the surface will blister, particularly on large drawings, for the paste adheres much better to a damp surface than to a dry one.

At this stage it is best to obtain some assistance. Have your assistant grasp two of the corners of the drawing or paper while you manage the others, holding the paper suspended horizontally a few inches above the cloth. When it is in the right position place your end on the paste-covered cloth, while your assistant still holds his end up. Place a piece of clean paper on top to prevent smearing the sheet, and with the hands brush quickly from the middle of the end toward both sides, working constantly toward your assistant as he slowly lowers the paper to the cloth. Rapid manipulation is necessary to insure perfect contact and a smooth surface.

Should any blisters develop, rub them briskly with the bone handle of an eraser, or any similar substance. Small undulations will disappear when the cloth dries. Stand the board aside with the cloth tacked to it, and allow to dry, then cut off as required.

Ordinary bleached cotton cloth or sheeting makes a good backing for small sheets, while large ones are best mounted on a heavy grade of unbleached material. These directions are general, and have been found to work well in practice. Individual experience can alone, however, determine many of the details.

Other paste than that described may be used if desired, though it is doubted whether a better can be obtained. Should any of your readers know of a better method, many would doubtless be glad to hear of it.

Railway Train Lighting.

At the May meeting of the English Institution of Civil Engineers, Mr. William Langdon read a paper on railway train lighting. He said:

The desirability of a better illumination of railway carriages had been long felt. The lamps originally provided were intended simply to enable passengers to enter and leave the carriages without inconvenience, but the exigencies of the present time called for the additional luxury of a reading light. The illuminants in use were rape oil, paraffine oil, compressed gas, and electricity, and the author dealt with the recent advances which had been made in connection with the last.

In October, 1881, a Pullman car, running between Victoria and Brighton, was lighted by electricity, and the experiment was so far successful that it was extended to the entire train, and at present there were sixteen trains so lighted belonging to the Brighton Company. Mr. Houghton, the company's electrician, and the late Mr. Stroudley, were the pioneers of the application of electricity to this purpose.

An interesting experiment, devised by Mr. W. H. Preece, F.R.S., was tried on the London and Southwestern Railway in 1883-84. The movement of the train was employed to compress air into a chamber, and the air so compressed was used to drive a dynamo to furnish the current for the lamps. In July, 1886, the Great Northern Railway applied electric light to one of their metropolitan trains. The Taff Vale and Cheshire lines had also made experiments in the same direction. In all these cases the lighting was effected by means of a dynamo driven from the axle of the guard's van combined with accumulators stored in the same vehicle.

In August, 1884, the London and Northwestern Railway tried a different principle in fitting up a short train which was still running between Manchester and Liverpool. The current was produced by a dynamo driven by a Brotherhood engine fixed to the tender, and supplied with steam from the boiler of the locomotive.

In this, however, as in the previous cases, the lighting was effected from one point, and should the train be broken up the part severed from the source of current would be left in darkness. In 1888 the directors of the Midland Railway authorized the equipment of two trains to run between London, Manchester and Liverpool, in which the following conditions were to be fulfilled, viz.: 1. Each vehicle was to carry its own lighting power. 2. Each vehicle was to be capable of being coupled and uncoupled and turned about as needed, without the possibility of the connections being wrongly made. 3. The coupling must readily draw apart when coaches were slipped *en route*. 4. The act of drawing the coupling apart must make all the changes in the connections necessary to transfer the lamps from the dynamo circuit of the train to the accumulator circuit of the carriage itself. 5. Each compartment was to carry not less than two lamps. 6. The lightng throughout the train was to be capable of being turned on or off from any of the guard's vans. For the sake of experiment, one of these trains was equipped on the "parallel" system, the other on the "series" system. The former having proved the best, had been adopted by the company, and there were now five trains leaving St. Pancras daily which were electrically lighted, and in which the dynamo was driven off the axle of the guard's van, each vehicle being provided with accumulators capable of supplying the necessary current without the assistance of the dynamo.

There was also a local train travelling between Manchester and Stockport lighted after the plan adopted by Mr. Houghton on the Brighton line, but equipped with two sets of accumulators and two dynamos driven from the axle. In addition to the foregoing, there were two trains running between London and Bedford, the dynamos of which were driven by small high speed engines placed on the locomotive.

Dynamos.—In all cases where accumulators were employed, it was necessary (*a*) that the dynamo should automatically come into circuit when the requisite speed to enable the electromotive force of the machine to overcome the back electromotive force of the batteries had been attained. (*b*) That the electromotive force should remain practically constant whatever might be the speed of the train. (*c*) That the current should always be in one direction, whichever way the vehicle was running. The first trains fitted on the Midland Railway were furnished with machines giving a practically constant output of current, no matter how few or how many were the carriages attached. Messrs. Holmes & Co., of Newcastle, had since succeeded in making a dynamo which afforded a current proportional to the resistance of the circuit, and these machines were employed on all main line trains in which the dynamos were driven from the axle. Automatic apparatus effected the stipulated requirements.

Accumulators.—These were of the "E.P.S." type. With main line trains, where each vehicle carried its own batteries, the type employed was C 15 for the larger, and C 11 for the smaller carriages. In all cases the electrical pressure was 35 volts, so that 18 cells were necessary for each.

Electrical Coupling.—Where trains were not broken up, the difficulty of providing an efficient electrical coupling was not so great, but where the marshaling of carriages had to be smartly dealt with at terminal or intermediate stations, the coupling must be such as not only to provide a good electrical connection, but admit of easy handling. The form adopted by the Midland Company effected these objects in a perfectly satisfactory manner. On a coupling being separated the lights were automatically turned on. If the lamps were not required the coupling, instead of being allowed to hang down, was placed upon a "dummy," the effect of which was to turn the current off. For slip coaches special provision was made.

By the insertion of a small resistance in each battery parallel, a fair distribution of the current throughout the different vehicles was attained, and in order to meet the increased pressure when the dynamo was in circuit, a sufficient additional resistance was automatically introduced. The lamps were of 8-candle power, and there were two in each compartment, safety fuzes being provided in connection with each group, as well as in connection with the dynamo itself. The circuits were arranged on the parallel system.

With regard to the second mode of generating the current, namely, by dynamos placed on the locomotive, it was believed that at present no other trains save the three already referred to were equipped in that way. Mention should, however, be made of experiments conducted on the Lancashire and Yorkshire Railway in 1884, and also, in the same year, by Mr. W. H. Massey, on the Metropolitan District Railway.

The extra staff required consisted, so far as the Midland Railway was concerned, of one senior officer and two train attendants at St. Pancras, one train attendant at Nottingham, Manchester, Bradford, and the services for about three hours per day of a man at Derby. The total number of electrically lighted vehicles now in operation on the Brighton, Great Northern, and Midland systems, was 365 coaches and 57 vans.

In conclusion, the author pointed out that the main points to be determined were whether electricity was safe, reliable and less costly than other illuminants. The fact that electrically lighted trains had now been running for a considerable period without accident would appear conclusive evidence of its safety, and experience had shown that there was no reason to doubt its reliability where efficient provision had been made; and the author believed that when the cost of applying any of the illuminants, whether oil, gas, or electricity, to a complete railway system, was taken into account, that the latter would be found the most economical. The cost of oil was between ¼d. and 1d. per lamp per hour. So far, compressed gas had never been employed for lighting the entire stock of any railway, with the exception of the Metropolitan Railway—which was specially adapted for its application. To consider the cost as applied to stock devoted to certain traffic would hardly afford a true basis of comparison. Where gas was used entirely, depots must be established at each point at which trains were made up, whilst at busy centers it would probably have to be conveyed some distance by pipes laid down for the purpose. The cost of fitting coaches for gas varied from £4 8s. to £7 per lamp, while for electricity it was £50 for a 6-bodied Midland main line coach, or £4 3s. 4d. per lamp. For trains running which were not broken up on the journey, the cost per lamp amounted to £3 12s., or £18 per 5-bodied coach. Vans with dynamos cost from £250 to £300 each. Statistics were given showing that the cost for maintenance in the case of gas was from .045d. to .250d. per light per hour. There was reason to believe that the total cost of compressed gas, when applied to an entire system, would exceed ¼d. per lamp per hour, while the actual cost for electricity, as used on the Midland Railway, had not greatly exceeded ¼d. per lamp per hour.

Regarding electricity as the illuminant which would, at no distant date, be universally employed for train lighting, the author suggested the desirability of arriving at a common basis with regard to the following fundamental points: 1. Electrical system. 2. Form and position of the electrical couplings. 3. Pressure of current. Unless this was effected it was to be feared that unnecessary difficulties might be created by the diversity of the plans adopted.

Coal Product of Illinois, Ohio, Indiana and Michigan.

Mr. John H. Jones, Special Agent U. S. Census, has prepared a condensed bulletin respecting the coal product of the States of Illinois, Ohio, Indiana and Michigan, the figures of which are, of course, obtained from the compilation for the present industrial census:

The following is a comparative statement of the product of coal in the States named for the tenth and eleventh censuses:

State.	Eleventh Census. Product. (Short tons.)	Value.	Tenth Census. Product. (Short tons.)	Value.
Illinois	12,104,272	$11,755,203	6,115,377	$8,779,832
Ohio	9,976,787	9,355,400	6,008,595	7,719,667
Indiana	2,845,057	2,887,852	1,454,327	2,150,258
Michigan	67,431	115,011	100,800	224,500

From the above it will be seen that Illinois shows the greatest increase in production over the tenth census, namely, 5,988,895 short tons. Ohio has increased her product 3,968,192 tons, and Indiana 1,390 730 tons. The increase in the value of product is as follows: Illinois, $2,975,371; Ohio, $1,635,733; Indiana. $737,594. The coal area in Illinois is reported as 37,000 square miles, in Ohio 10,000 square miles, in Indiana 7,000 square miles, and in Michigan 7,000 square miles. The coal from these States is bituminous, and is adapted for steam and heating purposes. The total number of employees engaged in the industry in Illinois is reported as 24,323, receiving in wages $8,694,347. The grand total of expenditures was $10,366,069. Ohio gave employment to 19,591 persons, who were paid $6,892,604 in wages. The total expenditures of all kinds in the production of coal were $8,232,183. Indiana, with her total number of 6,532 employees, paid $2,201,044 for wages, the grand total of expenditures of all kinds being $2,581,669.

The product of Michigan coal in 1889 was 67,431 tons, valued at $115,011. Compared with the tenth census report, these figures show a decrease in production of 33,369 tons and in value of $109,489. The total amount expended for wages, including office force, as reported for the eleventh census, was $93,594, the grand total of all expenditures being $113,714. There has been a gradual decrease in production in this State since 1882. The product of the mines of Pennsylvania and Ohio is delivered within the State at prices with which local operators find difficulty in competing.

The State of Illinois contains much the larger portion of what is known as the Central coal field, covering an area of about 37,000 square miles and underlying 60 counties, in but 45 of which, however, are operations conducted upon a commercial scale. The Illinois field contains 15 distinct seams. Those which are available for commercial mining generally lie at a considerable depth, and are reached by shafts. The coals of Illinois are bituminous, and furnish the most excellent steaming fuel. Coke is manufactured to a limited extent in Gallatin and La Salle counties, but elsewhere in the State the quality of the coal does not yield a marketable coke. The tonnage of coke produced in Gallatin county was 11,200, that in La Salle 1,700, a total of 12,900 tons only. Neither is it in any marked degree a good gas coal, although it is used for that purpose in some localities, rather because of its abundance than of its special adaptability. It is thought that the increasing facilities for the cheap transportation of Pittsburgh coal into the State will eventually exclude local coal from the manufacture of gas.

The total product of the State during the year ending June 30, 1880, as reported to the census, was 6,115,377 short tons, valued at $8,779,832, an average of $1.44 per ton at the mines. The product during the year 1889 was 12,104,272 short tons, valued at $11,755,203, an average of $0.97 per ton at the mines. The product reported by the State authorities for the year ending June 30, 1889, was 13,105,698 short tons. The falling off in production for 1889, as shown by the present report, is mainly due to an extensive and persistent strike of the miners in the northern districts of the State during six months of the year, but also in some measure to depression in the trade, resulting from the mild winter of 1888–89.

The total number of establishments of all kinds was 1,072, 358 being regularly operated mines, and 714 being known as local, these latter not being considered in the data as to labor and expenditures given above.

The six counties which lead in production with the number of regular establishments in each are given in the following table:

Name.	Production of Coal During Census Year. (Short Tons.)	No. of Regular Establishments.
Macoupin	1,339,112	15
Saint Clair	1,269,366	58
La Salle	973,832	21
Sangamon	894,703	17
Vermilion	593,208	22
Peoria	588,800	35

Of the total coal production of 12,104,972 tons, the amount which went into market was 11,584,361 tons, 9,884,883 tons being loaded on cars or boats at the mines for shipment, and 1,699,478 tons being sold for local trade at the mines.

The total number of men employed about the mines of Illinois, including office force, was 24,323, the wages paid during the census year aggregating $8,694,347.

The total amount of land owned by the coal operators was 162,468 acres, valued at $8,074,020; acreage leased, 30,272, valued at $1,816,644. Total acreage of land held, 191,740; total value of holdings, $9,890,664.

The total capital invested in the coal industry of the State was reported at $17,630,351.

The coal measures of Ohio cover an area of about 10,000 square miles, extending over the eastern portion of the State, the western border passing through the counties of Trumbull, Geauga, Portage, Summit, Medina, Wayne, Holmes, Knox, Licking, Perry, Hocking, Vinton, Jackson, Pike and Scioto.

The coal measures of the State are divided into three series, namely, the Lower measures, the Barren measures, and the Upper measures, but only the Upper and Lower measures contain workable veins. The principal seams are numbered from 1 to 8, beginning at the lowest or Sharon bed and ending with the Pittsburgh bed, at the bottom of the Upper measures. The Lower measures furnish the greater portion of the coal mined in the State, the most important seam of which is the great No. 6 or Hocking Valley. The coals now being worked are mainly from the seams designated as Nos. 1, 2, 6, 7 and 8. The varieties are, however, better known to the trade by the names of the local districts producing them.

The coal beds of Ohio, like all others of the Appalachian field, embrace all the varieties of bituminous, steam, coking, gas and cannel coal. The larger part of the product is adapted for coking and steam, although the block coals of the Hocking valley and other sections have been extensively used for blast furnaces, but are now being superseded

for that purpose by the Connellsville cokes. Very little Ohio coal is used for gas manufacture, owing to the convenience of obtaining the better gas coals of Pennsylvania. The cannels are found, as is usual, in pockets, varying in thickness and extent, but never of any great economic value, the low per cent. of volatile matter detracting from their efficiency in the manufacture and enrichment of gas. Hence they have obtained only a local importance.

The total quantity of coal produced in Ohio during the year ending June 30, 1880, as reported to the tenth census, was 6,008,595 short tons, valued at $7,719,667, an average of $1.28 per ton at the mines. During the year 1889 the total production, as reported to the eleventh census, was 9,976,787 short tons, valued at $9,355,400, an average of $0.94 per ton at the mines.

The total amount of coal put into market was 9,763,095 tons, including 8,566,223 tons shipped from the mines in boats and cars, and 1,196,872 tons sold for local trade at the point of production.

Four counties manufactured coke on a commercial scale, these in their order, with their production, being shown in the following table:

Athens County	39,002	short tons.
Mahoning "	22,500	"
Belmont "	5,000	"
Jefferson "	2,947	"
Total	69,449	short tons.

The production of coal in the six leading counties in the order of their importance is shown in the following table:

Name of County.	Total Product of coal. (Short tons.)	No. of regular establishments.
Perry	1,565,786	38
Athens	1,224,186	29
Jackson	926,874	36
Stark	851,994	26
Hocking	845,049	10
Tuscarawas	683,505	27

The number of regular establishments in the State of Ohio was 323, of local ones, 1,745; total, 2,068. The total number of employees was 19,343; total amount of wages paid, $6,730,778.

The holdings of the coal companies comprised 66,697 acres of land owned and 38,210 acres leased, having a total value of $9,027,640. Total capital invested was reported at $14,018,236.

The coal field of Indiana is an eastern extension of the Central or Illinois field, underlying an area of about 7,000 square miles, and includes 19 counties, Warren county lying at the northern limit and a line drawn through the eastern boundary of Green county marking its extent eastward. The general character of the coals of this State, like those of Illinois and Western Kentucky, which comprise the remaining portion of the field, are bituminous, and excellent for steam and heating purposes, but of little value for the manufacture of coke and gas. Cannel coal, which appears in pockets in various portions of the Indiana region, has not attained more than local importance, either for domestic fuel or for the manufacture of gas.

There being no authorized system of collecting the statistics of production of coal in this State, the figures published heretofore from year to year must be taken as approximates to some extent. The State mine inspector, in the course of his duties, has secured whatever data was available on the subject, and his estimates may be relied upon as representing very nearly the actual facts. Assuming these figures to be correct, it is found that the production of coal in the State has declined since 1887, the year of maximum output. This condition is owing to the introduction of natural gas into the cities and larger towns, together with the use of crude oil as fuel at Chicago and elsewhere, thereby displacing the Indiana coals in many important nearby markets.

The production as reported by the mine inspector, was as follows for the years named: 1887, 3,217,711 short tons; 1888, 3,140,979 short tons. The product for the year 1889, as reported to the census, was 2,845,057 short tons, valued at $2,887,852, an average of $1.02 per ton at the mines. During the year ending June 30, 1880, the quantity of coal produced in the State, as reported to the 10th census, was 1,454,327 short tons, valued at $2,150,258, an average of $1.48 per ton at the mines.

The production of coal in the 6 leading counties, in the order of their importance and the number of regular establishments in each, is shown in the following table:

Name of County.	Production of coal in census year (short tons).	No. of regular establishments.
Clay	695,649	28
Vigo	371,903	8
Parke	357,434	4
Sullivan	317,252	12
Daviess	191,585	8
Vermilion	187,651	4

Coke was manufactured in only two counties, Sullivan and Pike, the production being 8,000 tons in the first and 4,800 tons in the last named county, a total for the year of 12,800 tons.

The total number of establishments was 350, 94 being regular and 256 of local use only. The total number of employees was 5,782, and the amount paid for wages was $2,144,566.

The value of Indiana coal lands was reported at $1,789,495, there being 15,785 acres owned by operators, valued at $1,213,445 and 9,023 acres of land, valued at $576,050. Total number of acres, 12,808. The total capital invested in coal production in Indiana was reported at $3,435,703.

In Michigan coal is mined in six counties, namely, Calhoun, Clinton, Eaton, Jackson, Huron and Shiawassee, although this northern field, which is a detached deposit not identified with the important coal fields of the Mississippi river, underlies the whole or portions of 15 counties in the southern central section of the State, including, in addition to those above named, Saginaw, Ionia, Montcalm, Gratiot, Isabella, Midland, Tuscola, Genessee, Ingham, Bay and Liverpool counties, covering an aggregate area of nearly 7,000 square miles.

Coal mining in this State has been unprofitable, the better coals of Pennsylvania and Ohio being delivered to points within the State at prices with which local coals cannot compete. Recent analyses exhibit fixed carbon 45 and volatile combustible matter 49, showing a good steaming fuel, and much the greater portion of the output is disposed of to railroad companies and manufacturers for engine use.

Owing to the conditions above stated the production has fallen off somewhat during 1889 as compared with the previous year. Prior to 1880 the aggregate output was about 500,000 short tons. The production reported to the Tenth Census for the year ending June 30, 1880, was 100,800 short tons, valued at $224,500 at the mines, an average of $2.23 per ton. The output for the year 1889, as reported to the census, was 67,431 short tons, valued at $115,011, or an average of $1.71 per ton at the mines. The largest production for any year was in 1882, when 135,339 short tons were reported, since which there has been a gradual falling off.

The production of the different counties in the order of their importance and the amount of coal put into market, is shown in the following table:

Counties.	Number of Regular Mines.	Number of Local Mines.	Total Product of Coal of Grades for 1889. (Short Tons.)	Loaded at Mines for Shipment on Railroad Cars and Boats. (Short Tons.)
Jackson	4	1	47,731	37,295
Shiawassee	1		18,134	15,634
Eaton		3	812	
Clinton		1	364	
Calhoun	1		350	175
Huron		1	40	
Total	6	6	67,431	53,104

No coke was made within the State.

The total number of employees about the mines was 261; total amount of wages paid, $93,594.

The total value of land holdings by coal operators within the State was put at $17,400, there being 142 acres of land owned, valued at $7,800, and 480 acres leased, valued at $9,600. The total capital invested in the coal industry of the State was reported at $49,650.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

A SUIT considerably out of the common has just been tried at Seattle, Wash., before Judge Osborn and a jury, in which the Oregon Improvement Company sought to recover from the Seattle Gas Light Company the sum of $168.40, for wharfage for landing 421 tons of shale on Ocean dock, in July, 1890, at the rate of 40 cents per ton. In its answer to the complaint the Gas Company not only refused to admit its liability, but put in a counter claim for $1,880 for the loss of 80 tons of shale valued at $23.50 per ton. The Gas Company, on July 12, 1890, applied to the Oregon Improvement Company for a berth for the ship Kate Davenport, for the purpose of discharging 501 tons of shale, and the ship was directed to take a berth at what is known as the Ocean dock, owned and operated by complainant. Defendant asserts that when about 300 tons of the shale had been unloaded the wharf, which was old and rotten, gave way, precipitating 80 tons of the shale into the bay. Negligence is charged to the Oregon Improvement Company in maintaining a decayed and unsafe wharf, but that Company claims to have notified the Gas Company that it would not be safe to have much of a load on the wharf, and that it directed defendant to remove the shale as rapidly as it was unloaded, thus not allowing it to accumulate on the shaky structure. Defendant did not pay heed to these instructions, hence complainant asserts that no responsibility rests with the latter.

THE Directors of the consolidated gas interests of Rochester, N. Y., offer for sale the following properties: The property on Canal street, formerly owned by the Municipal Gas Light Company; that on North St. Paul street, corner of River street, formerly owned by the Rochester Gas Light Company, and the plot on North St. Paul street, at one time occupied by the Citizens' Gas Company for office purposes. There is a verp simple lesson in this announcement for those who hold that there can be such a thing as live, permanent competition in the gas supply of cities or towns.

AT the annual meeting of the stockholders in the San Jose (Cal.) Light and Power Company a full representation of the shares is reported. After satisfactory reports from the officers had been read, it was voted to put aside $20,000 with which to complete the improvements on the gas plant, the same to be finished in three months. The following officers were then chosen: Directors, Adam Rheil, Uriah Wood, Amasa Eaton, C. W. Quilty, J. K. Pryor, C. B. Cornwall and Lloyd Tevis; President, Adam Rheil; Vice-President, C. F. Ryland; Secretary, W. W. Gillespie; Superintendent, E. D. Mills. This is Mr. Gillespie's sixth year with the Company.

AT a recent meeting of the Board of Directors of the Commercial Club, Nashville, Tenn., the Committee on Public Policy, consisting of J. A. Cartwright, G. N. Tillman, A. S. Colyar, J. M. Head, H. W. Morgan and W. F. Glenn, made the following repart, which the Board adopted: "The undersigned, to whom, as a committee, was referred what may in brief be termed the gas question, beg leave to report that there is an unanimity of opinion among the citizens, in which we most earnestly concur, that it would be unwise and positively wrong to undertake to make any contract with the Gas Company, providing for a maximum price to be charged individual consumers of gas: First—Because the city has no right or power to make such a contract, and to enter into such contract under present conditions would only arouse suspicion as to the good faith of those city officials favoring it, and precipitate controversy and litigation in the near future. Second—Because it would embarrass the right of the city, made perfect and effectual by an act of the recent Legislature, to purchase the property of the Gas Company at an appraised value, should it be deemed expedient, after the Gas Company shall have had ample time to meet the just demands of the citizens for a reasonable price. Neither, in the opinion of the undersigned, should the city contract for the lighting of the public streets for any long period of time, certainly not longer than for one year, in order that the whole question may be left open for the formulation of some plan of action and well directed effort to obtain gas, both for public purposes and private consumers, at a price which actual results in other cities demonstrate to be reasonable. Third—Because, as a question of law, the committee is advised that the City Council has no right to grant exclusive privileges to said Gas Light Company, and thus to create a monopoly; and that if such monopoly should thus be created, such grant would be void and not bind any subsequent Council. Fourth—That while it might not be wise at present for the city to undertake the ownership and operation of gas works, yet unless the Council shall so protect the interests of the city and of its citizens in procuring cheaper gas, steps should be taken looking to the city's ownership and operation of its own gas works."

THE Mount Vernon (O.) Gas Light and Coke Company has instituted suit against the local authorities and Messrs. Brooks & Eslow, alleging that the city and the firm named (the latter are general contractors) have, in their prosecution of the work of sewer construction, caused considerable damage to the gas mains. The bill of particulars filed by Messrs. McIntire and Koons, attorneys for the Company, is as follows: "Plaintiff is a corporation duly organized under the laws of Ohio, having its office and place of business in the city of Mount Vernon, county of Knox, and State of Ohio; that its business consists in the manufacture and sale of illuminating and fuel gas for the consumption of the defendant, the city of Mount Vernon and the inhabitants thereof; that said gas can only be safely and conveniently conveyed from plaintiff's factory to the place convenient for the consumption of the same by means of iron pipes placed underground; that under a grant and license duly given to the plaintiff by the defendant, the city of Mount Vernon, and under the authority and direction of the officers and agents of said city the plaintiff many years ago, at a great expense, excavated trenches and placed underground, along certain of the streets of said city, cast and wrought iron pipes, of a suitable size and proper depth for the conveyance of the said gas thus manufactured by it, and has ever since maintained said pipes in good condition up to and at the time of committing of the grievances hereinafter complained of, and has at that time a line of said pipes running the full length of Main street in said city, the nature and location of which line was well known to the officers and agents of said city; that between the 1st day of January, 1891, and the 1st day of June, 1891, the said defendant, the city of Mount Vernon, along with the defendants Thadeus C. Brooks and James A. Eslow, who are co-partners doing business under the firm name of T. C. Brooks & Co., have caused to be excavated along the whole length of said Main street a wide and deep excavation for the purpose of the construction of a sewer under said street; that the said excavation was located and made unnecessarily near the said gas pipes of plaintiff; that no sufficient precautions were taken by putting in props or supports to prevent the falling in of the wall of said excavation while work was in progress; that by reason of the failure of the said defendants and their agents and employees to make proper and reasonable provisions for the protection of plaintiff's said gas pipes, and by reason of the grossly careless manner of making said excavation, the walls thereof fell in, and in that way crushed, bent and broke the plaintiff's said gas pipes, and the injury thus occasioned to plaintiff's said gas pipes was wholly unnecessary to the proper construction of the said sewer. Plaintiff says that it has already been put to great expense for labor and material for repairs to its said pipes made necessary by the said injuries thereto, and that owing to the unnecessary displacement of the earth adjacent to its said pipes occasioned by the falling in of the walls of said excavation said pipes have been so injured that in a great part of the distance along the line of said sewer they will have to be taken up and relaid, and plaintiff says that by reason of the premises it has been damaged in the sum of $290, for which it asks judgment against said defendants."

MR. J. H. DECKER has resigned his position as Secretary, Treasurer and Superintendent of the Salina (Kas.) Water Works Company and a like place at Winfield, Kansas, in order to take charge of the department of supervision and maintenance of all water works and other large pumping plants erected by the H. R. Worthington Company. His headquarters will be at 86 and 88 Liberty street, this city. Welcome to New York, Mr. Decker! And it is with great pleasure that we congratulate him on the excellent position bestowed upon him. The Worthington Company, too, is to be congratulated on having secured the services of so competent and clever a man.

WE are indebted to a local correspondent at Janesville, Wis., for the following, respecting the gas supply of that city: "The growth of the gas companies of any city is, to a certain extent, an epitome to the advancement of the city itself, for the consumption of gas and the extension of gas mains mark the growth of the best class of residences and the settlement of the well-to-do classes from whom the most material advance is expected. The New Gas Light Company of Janesville was established in 1856, and at once began the manufacture and distribution of gas in the city, advancing as the needs of the city demanded. This Company has reached a position among manufacturers equal to any in a city of equal population, having over 13 miles of pipe laid in the city and suburbs. The city is brilliantly lighted by this Company at a much lower rate than at the initiation of the works. This reduction, as well as the reduction in price to consumers, speaks louder than words of the extreme liberality practiced by Mr. Merrill in his dealing with the public, as all reductions both to city and private consumers were made at his own option. The Company furnishes gas for illuminating purposes, cooking and heating stoves and grates, of which there are at present in the city over 400. The works are situated in the north end of the city and are fully supplied with all modern appliances known to the science of gas manufacture. An ample force of hands is regularly employed in its various departments, while on occasions of main extensions the number reaches a very large amount. The works are controlled by Mr. H. Merrill, who will use nothing but the most accepted methods. Additions to the capacity of the works will be made as the demand requires. The works are now, however, sufficient for the needs of a city of 25,000, with every appliance for the production of illuminating and heating gas. To Mr. Merrill our citizens feel indebted for this convenience, and so long as he has control of the enterprise we can safely say our city will be supplied by a superior quality of gas.

AT a special election of the residents of Fairmont, Minnesota, it was decided to issue $15,000 bonds for the purpose of instituting a system of water works and installing an electric light plant.

WE understand that the gas works at Livermore, Cal., were shut down some weeks ago. Lack of patronage was the cause.

ACCORDING to a local authority, the Rockford (Ills.) American Gas Company has just placed in the hands of Ald. Woolsey, who is chair-

man of the city lighting committee, a proposition that is certainly very generous and deserving of serious consideration, whatever the result. As is well understood by the terms of an early day contract between the city and the Gas Company whenever the city decides to abandon the use of gas lamps it will have to pay to the Company a certain sum for the lamps, the total being about $5,500. This sum is a direct debt on the city and cannot be avoided if the city ever undertook to make a change in the method of lighting. The Gas Company, however, now offers to cancel that claim, provided the city gives it a contract to light the streets for 5 years longer. Further than this, it will light the streets for $20 instead of $23 a lamp, as at present, and will also light the lamps without additional expense on dark nights, when the moon, though expected to shine, seems to have forgotten her duty. This would be quite an additional saving to the city, as at present, when the streets are lighted on dark nights, exclusive of the contract, the Gas Company charges extra for it. For instance, during the past month, there has been incurred an additional expense of $100 to the city, for gas furnished when the moon did not do its duty. There are now about 550 lamps, and at the reduction of $3 per lamp in the yearly cost of lighting, the city will save $1,650, and in the expense of lighting dark nights when the moon ought to shine, at least $500 a year, making over $2,000 saved yearly on the present contract. This, with the $5,500, makes nearly $8,000 which the Gas Company will present to the city next year. It further agrees to reduce the cost of lighting per lamp to $19 per year when there shall be 650 lamps, and this is liable to be within a year. The liberality of this proposition may be realized when it is noted that the city of Chicago pays $20 a lamp right along, although there are between 10,000 and 12,000 lamps. Rockford, with only 550, makes the same price. The general desire to see the city lighted with electricity sometime, is, of course, conceded, but to put in an electric plant will involve a very large expense which the city, it is urged, cannot well undertake with its present large amount of improvements and expenditures staring it in the face. Its first plunge in this direction will require the payment of $5,500 in cash to the Gas Company, and this is no small thing. The complaint of poor lighting which has been prevalent for some time is largely occasioned by the fact that heretofore on nights when the Gas Company was not required to light on account of the expected moon, the city refused to pay for the extra lighting, and the Gas Company has not felt like making it a present of the gas. Under the new proposition the city will be lighted fully on every dark night, and the contract will be so that the city can make the Company pay for any failure to do this. The proposition is certainly a very reasonable one, and with the great expense that a change of the system of lighting would involve, it is believed by many that it could not well be brought about inside the next five years anyway, and there will be a strong disposition on the part of conservative people to accept the Gas Company's offer, with the prospects of a great improvement in the gas lighting, and thus affording the city ample time to provide for the possible electric system at the end of this time, if it should be advisable.

THE sendout of the Richmond County (Staten Island) Gas Light Company shows an increase of 15 per cent. over the figures reported for the previous twelve months.

ADVICES from Bay City, Mich., under date of June 24th, are to the effect that on that date fire was discovered in the engine room of the Bay County electric light works, at 7 o'clock, and before it was controlled the works were damaged to the extent of $25,000. All the machinery was rendered useless, and those dependent upon the plant for light were put to great inconvenience. The Directors decided to rebuild at once.

ACCORDING to the New York *Sun*, the Committee on Coal, of the Western Freight Association, in a report to Chairman Midgely, recommends that such lines in the Association as desire to do so may join the Baltimore and Ohio in through rates on gas coal at $2.50 per net ton from Pittsburgh to the Mississippi river on business destined to points beyond, allowing the Baltimore and Ohio a minimum of $2 per ton east of Chicago. The Iowa Central was the only member of the Committee that refused to vote for this adjustment, its position being that it could not consent to it unless satisfactory arrangements were made with the Eastern lines via Peoria on this business. Mr. Midgely decides that the lines west of Chicago should receive 28 per cent., or 70 cents per net ton on shipments of gas coal, as that is the basis of the existing arrangements with the Eastern lines. As the matter is to be appealed to the Commissioners of the Western Traffic Association, Mr. Midgely advises the Western roads to accept no less in the meantime than their regular percentage of the gross rate from Pittsburgh to East St. Louis.

THE proprietors of the Mount Sterling (Ky.) Gas Company are making important improvements on the plant. A new holder (to store 20,000 cubic feet) has been contracted for, and a larger leading main will be put down through Main street.

THE new public lighting contract at Ballston Spa, N. Y., calls for the keeping in duty all night and every night of a certain number of lamps. The agreement is to last for five years.

SHERIFF WEST, of Camden, N. J., recently made a levy on the plant of the Merchantville (N. J.) Gas Light and Fuel Company, to satisfy an execution issued by F. C. Lingg on a judgment of $2,000.

THE District Commissioners have granted permission to the Washington Gas Light Company to lay mains on K street, between 11th and 12th streets, northeast; on R street, north side, between New Hampshire avenue and 18th street, northwest; on north side of 18th street, between Sherman avenue and R street, and on 11th street, between H and K streets.

WE regret to have to say that Mr. Peter Coffey, Superintendent of the Peoria (Ills.) Company, is suffering from a severe fit of sickness.

ARTICLES incorporating the State Light Company have been filed with the County Clerk of Oakland, Cal. The purposes of the corporation are: To manufacture, produce, sell, distribute and supply electric power and artificial light to each and any city in the State; to transact the business of electrical construction and supplies in any and all their several branches, etc. The capital stock is $2,500,000, of which $50,000 has been subscribed by the following capitalists: W. C. Ralston, L. D. Smith, Chas. C. Read, J. B. Dyer and Howard H. Shinn.

THE Chicago *News*, of June 26th, says that an ordinance of more than usual interest was introduced in Councils, by Ald. Vierling. It proposes to give the Chicago Economic Fuel Gas Company the right to bury pipes for the distribution of illuminating as well as fuel gas. In December this Company was privileged to lay mains for fuel gas anywhere within the city limits, under certain regulations, and the owners of that franchise now propose to manufacture and distribute illuminating gas also at a price never to exceed $1.10 per 1,000 cubic feet, with a bonus of 3½ per cent. of the gross receipts to be paid yearly into the city treasury. They urge that if permission is granted them to lay illuminating gas mains in the *same trenches* and at the *same time the fuel gas mains are laid*, the city will be the gainer, in that the *streets will thus be disturbed but once!*

WE had a call the other day from Messrs. Fav and McManus, of the Denver (Col.) Gas Company. Mr. Fay is in fine health and spirits—in fact, he never looked better in his life; and as he emphatically said that he felt fully as well as he looked, that ought to settle the question. Secretary McManus is also on the able-bodied list, and is confident that the Denver Company can easily hold its own.

MR. EGNER is now permanently in New York city, and will at once take charge of the Standard Company's works.

The Market for Gas Securities.

Continued dullness is the report from Wall street this week, particularly in respect to city gas shares, Consolidated to-day (Thursday) being quoted at 92½ to 93, with virtually no business in it at all. Equitable holds its own at 118 to 120, as does Mutual. In common with others we hail with pleasure the appointment of Mr. Egner to the position of Chief Engineer to the Standard Gas Light Company. He is now in charge, and if the amateurs in the Directorate will only keep their hands off—and their mouths shut—for a while, we think the Company will soon develop symptoms of unmistakable progress.

In Brooklyn, matters are going along smoothly, and the shareholders are about over their fright. Quotations in Brooklyn shares are appended: Brooklyn, 100 to 102; Fulton Municipal, 115 to 120; Peoples, 80 bid; Metropolitan, 95 to 100; Nassau, 130 to 140; Williamsburgh, 115 to 125. A sharp squeeze in the money market Saturday and Monday drove Chicago gas below 50, but later on it rallied; the opening quotations to-day being made at 50½. Laclede common is at 10 to 15.

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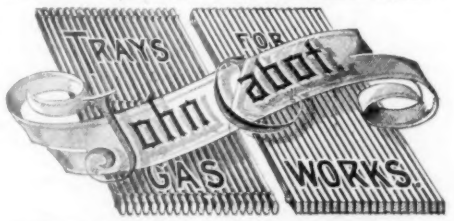

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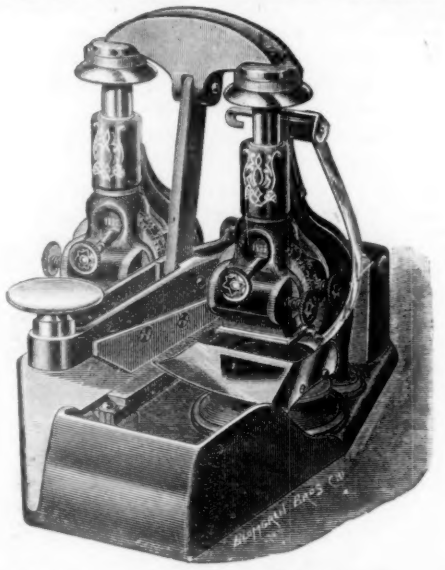

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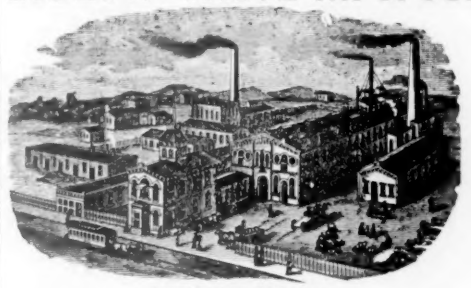

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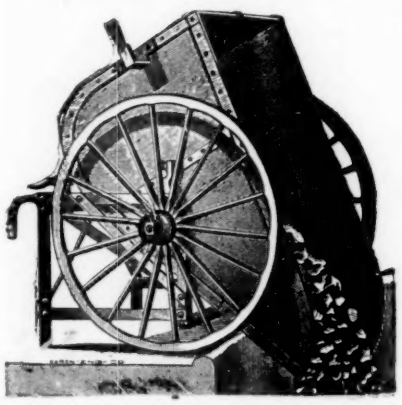

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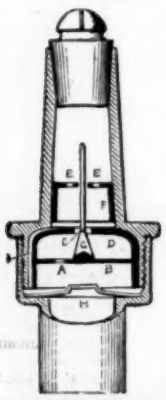

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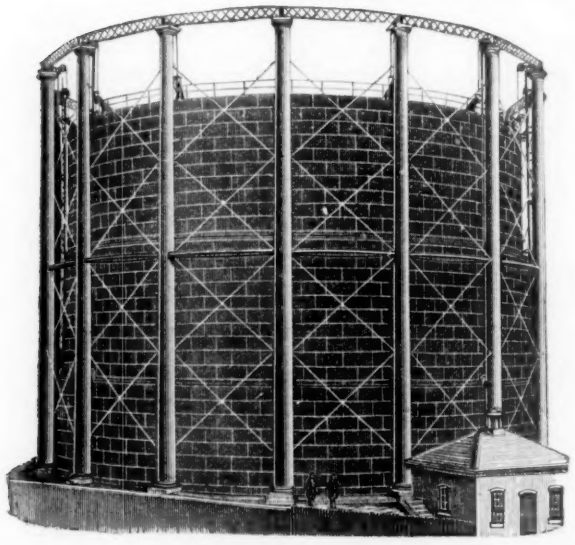

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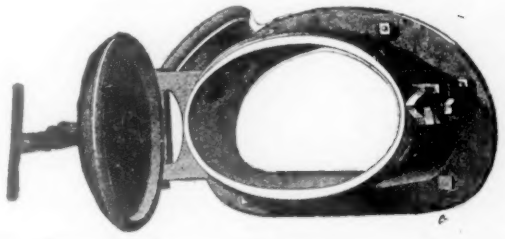

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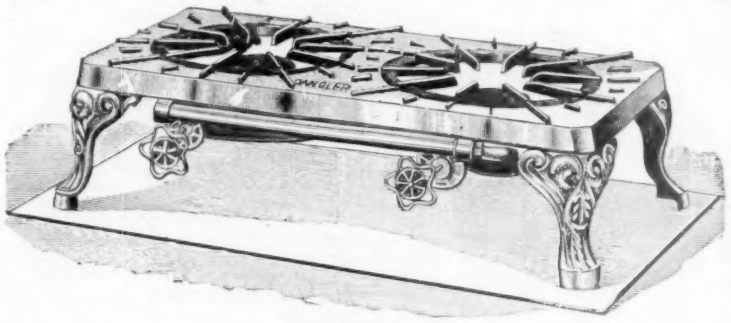

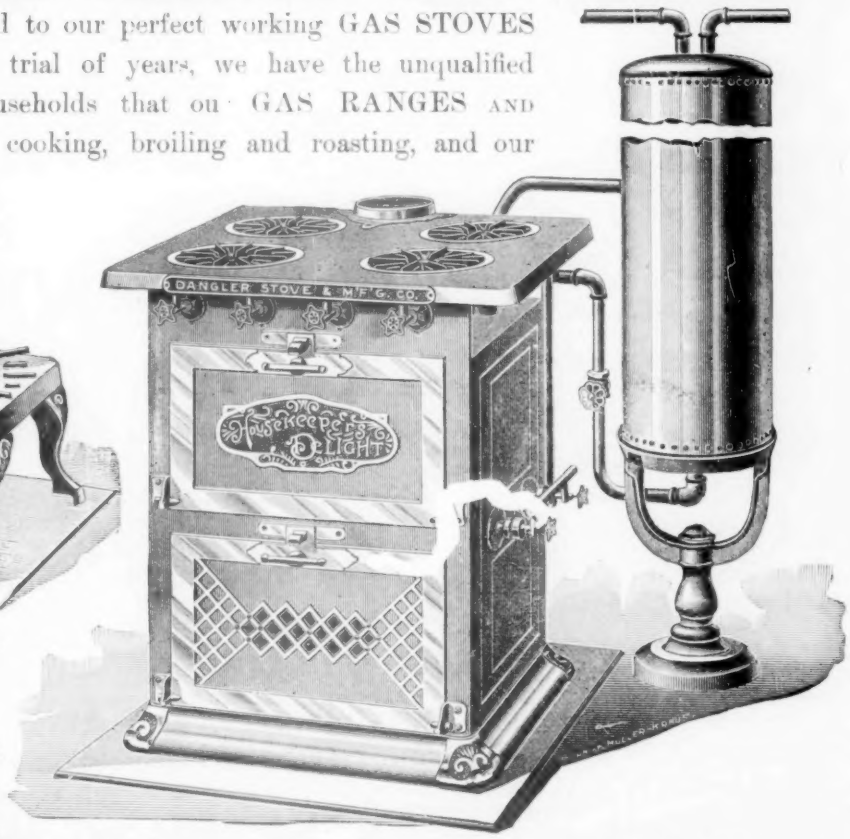

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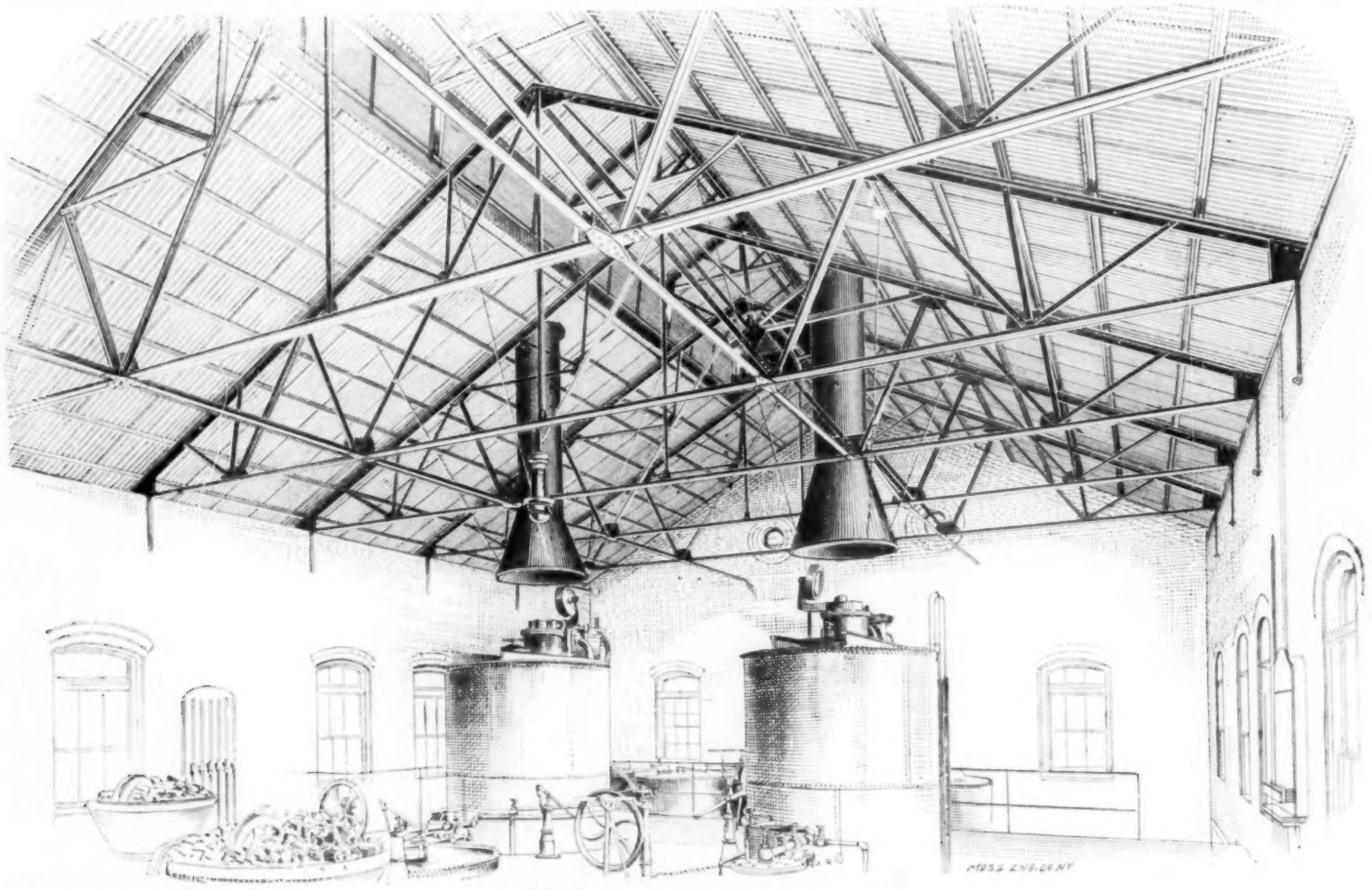

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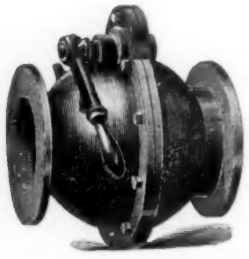

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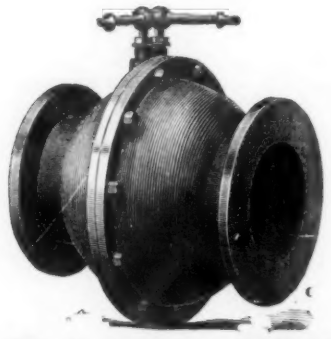

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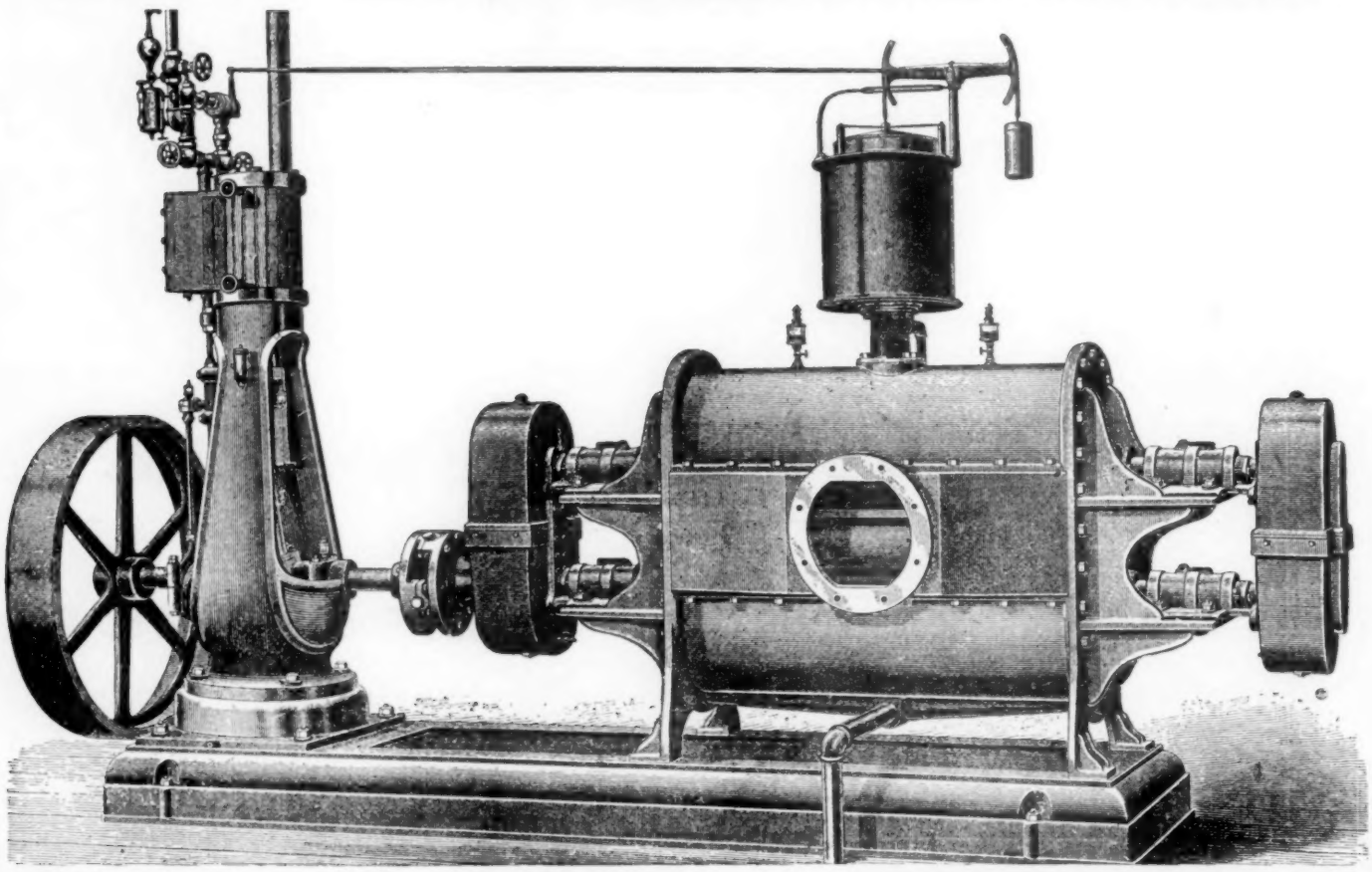

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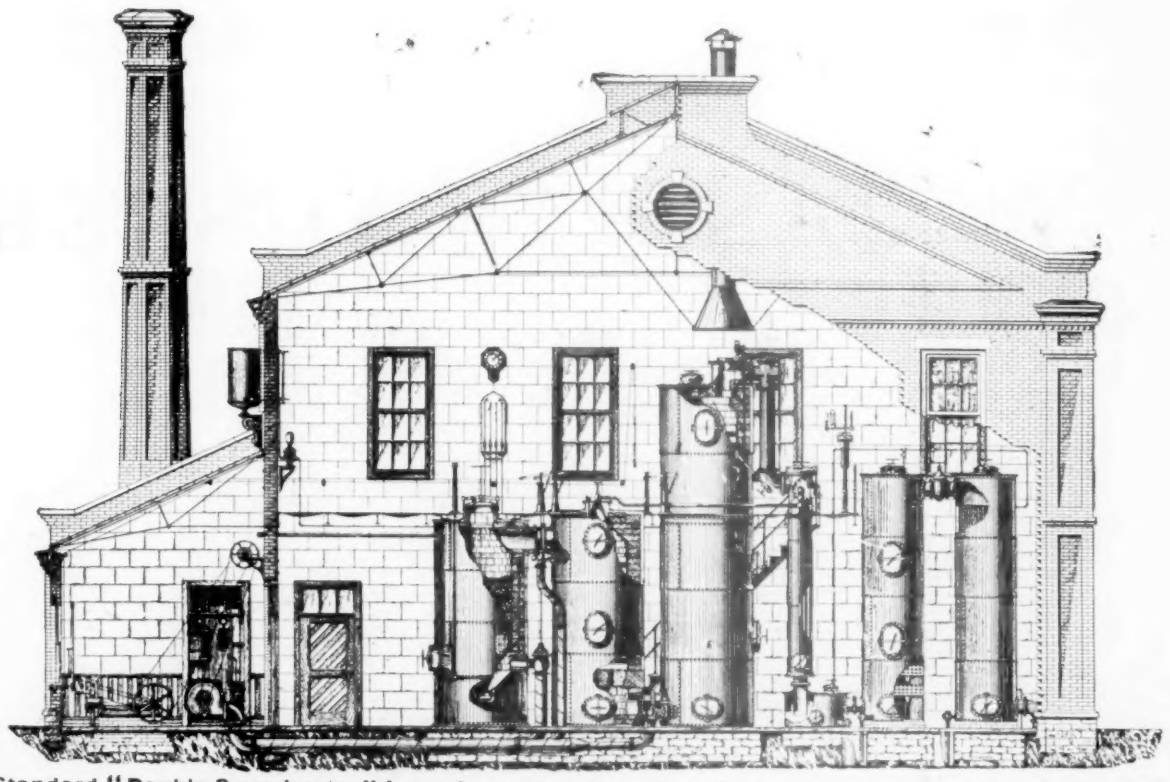

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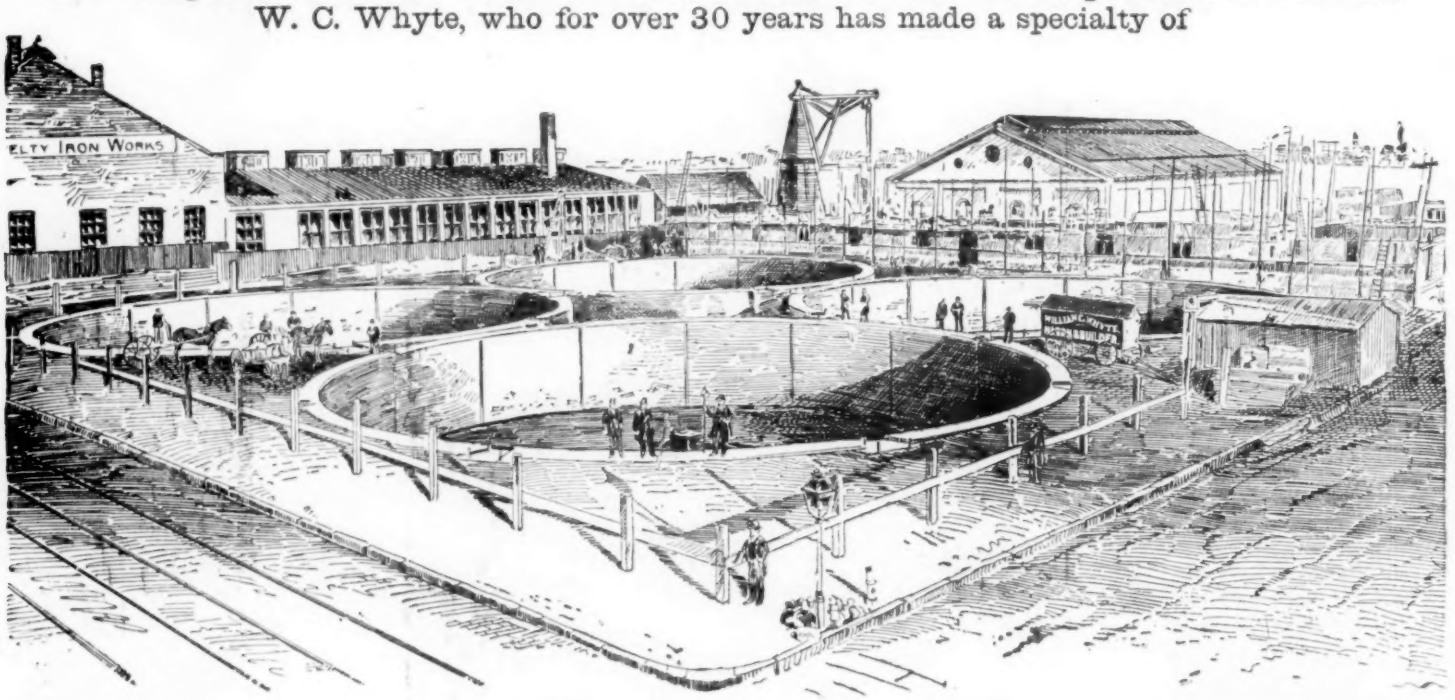

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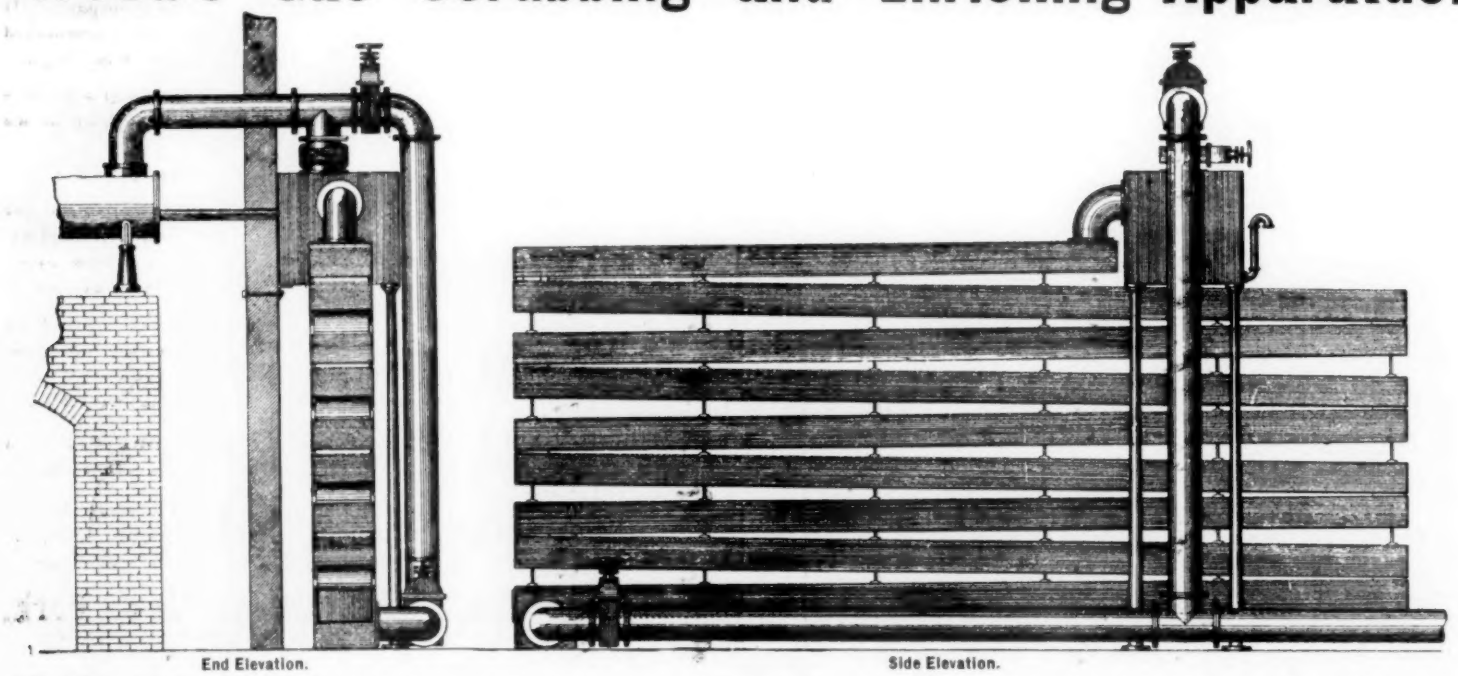

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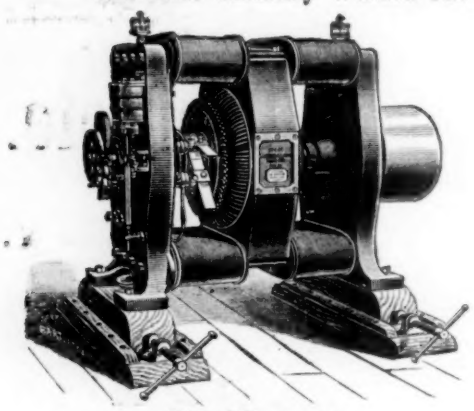

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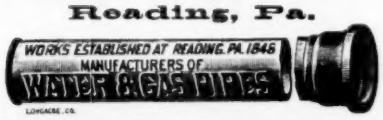

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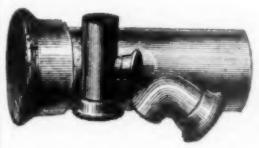

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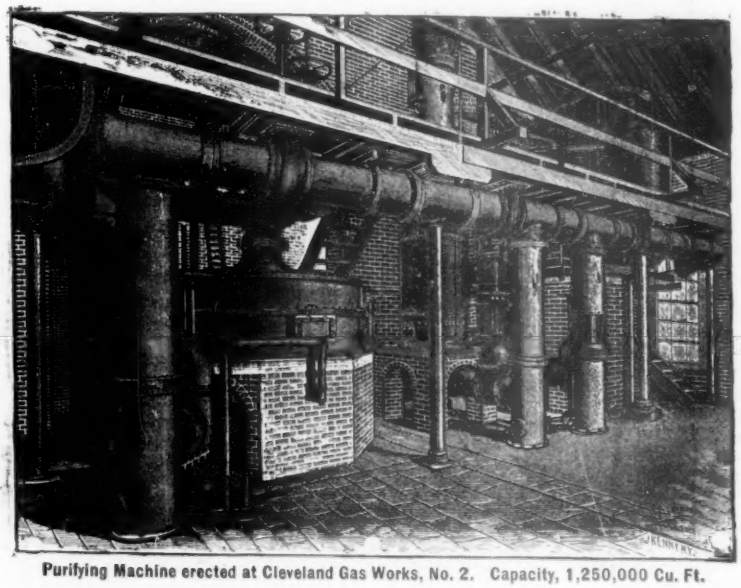

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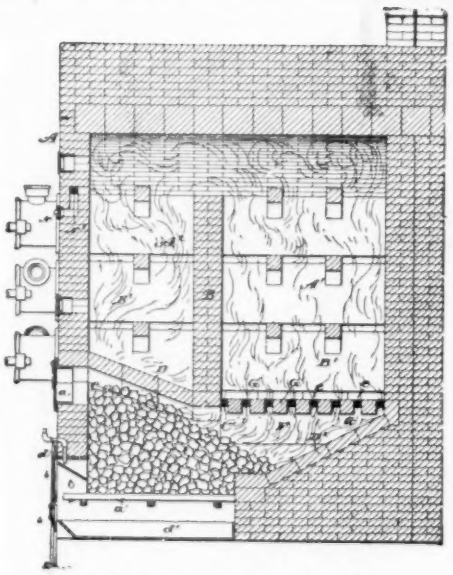

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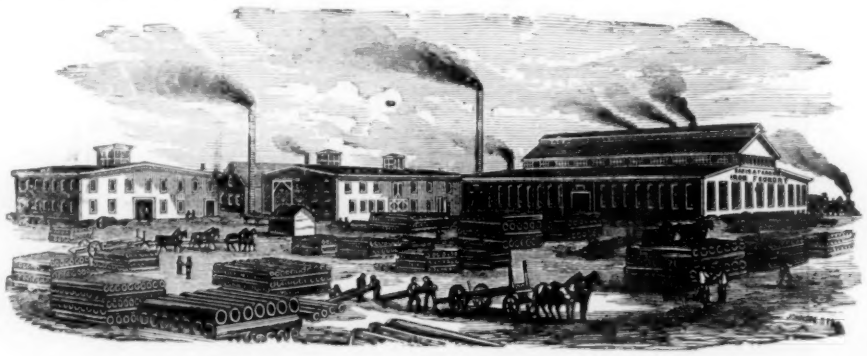

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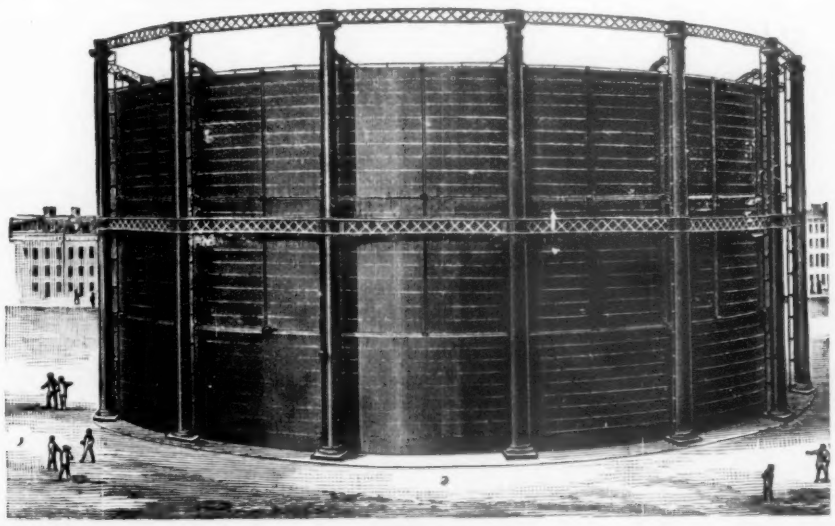

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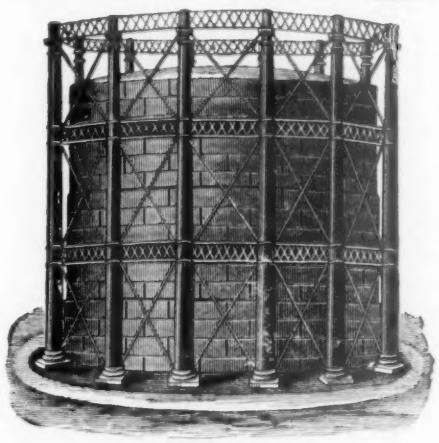

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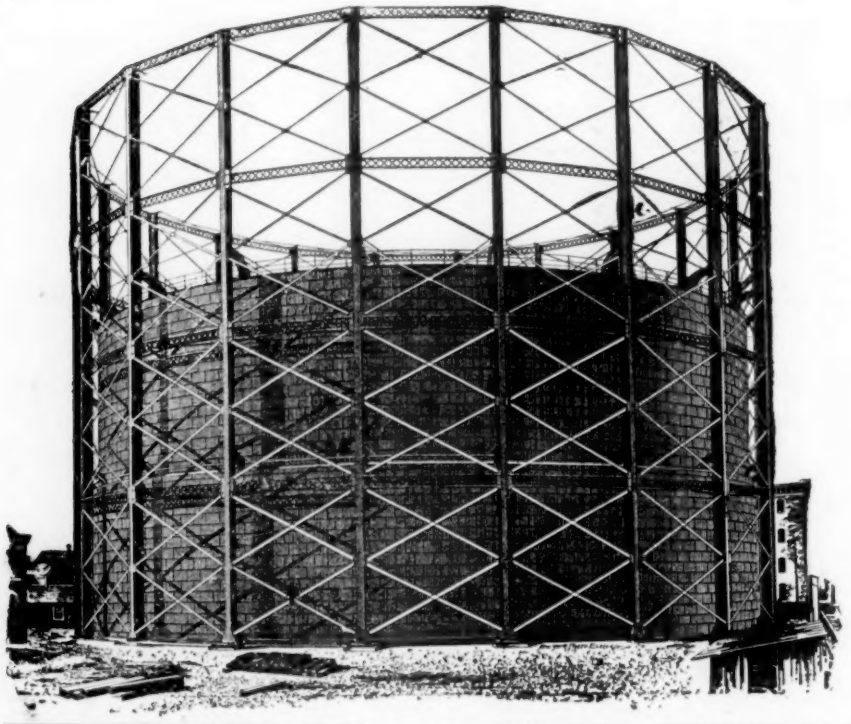

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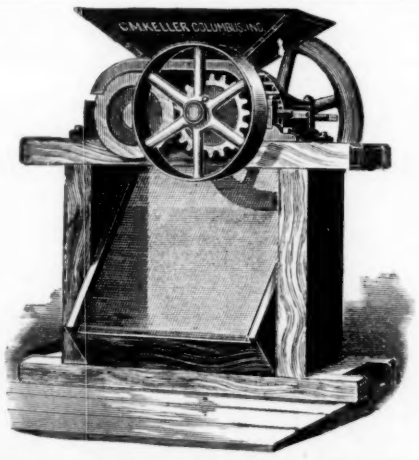

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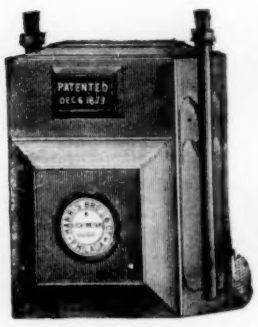

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